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HIMALAYAN FOSSILS.

Vol. V, Memoir No. 1.

FAUNA OF THE TROPITES-LIMESTONE OF BYANS.

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HIMALAYAN FOSSILS.

VOLUME V, MEMOIR NO. 1.

THE FAUNA OF THE TROPITES-LIMESTONE OF BYANS.

(COLLECTIONS MADE BY THE GEOLOGICAL SURVEY OF INDIA DURING THE YEARS 1899 AND 1900.)

BY

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INTRODUCTION.

The first discoveries of cephalopoda of upper Triassic age in Byans were made by C. L. Griesbach in a grey limestone near Kalapani in the upper valley of the Kali river, where the north-eastern corner of Kumaon borders upon Nepal and Tibet. The credit of the correct interpretation of those fossils is, however, due to E. von Mojsisovics. Among the materials collected by Griesbach in the limestone of Kalapani and erroneously considered as "Lias," he was able to distinguish a small number of forms, which seemed to be most nearly allied to species of the Alpine *Subbullatus*-beds of the upper carnic stage.[1] This interpretation was accepted by C. L. Griesbach, who, in a letter published in the "Anzeiger" of the Kais. Akademie der Wissenschaften (1892, p. 174), stated that the limestone of Kalapani, formerly termed by him "Lias," occurred in a mountain region extremely disturbed, the tectonic features of which had probably not been correctly understood.

A full description of the meagre fauna of the Tropites-limestone of Kalapani has been given by E. v. Mojsisovics in the third volume of this series. The fossils were, unfortunately, too badly preserved to allow of a specific determination, but the carnic type of the fauna showed itself so clearly in spite of the great deficiency of the material, that E. v. Mojsisovics did not hesitate in correlating this horizon of the Himálayas with the Alpine zone of *Tropites subbullatus*.

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[1] *E. v. Mojsisovics,* Vorlaeufige Bemerkungen ueber die Cephalopodenfaunen der Himálaya-Trias. Sitzgsber. Kais. Akademie der Wissensch. Wien math. nat. Klasse, Bd. CI. 1 Abth. Mai 1902.

The following forms have been described by E. v. Mojsisovics :—

1. *Jovites nov. f.* ex aff. *J. Bosnensis* Mojs.
2. „ *cf. Dacus* Mojs.
3. *Tropites Kalapanicus nov. sp.*
4. „ *nov. f. cf. acutangulo* Mojs.
5. „ *f. ind. cf. fusobullato* Mojs.
6. „ *f. ind. cf. discobullato* Mojs.
7. „ *nov. f. ind.*
8. *Entomoceras f. ind. cf. sandlingense* Hauer.
9. *Sagenites f. ind. cf. inermis* Mojs.
10. *Trachyceras nov. f. ind.*

The genus *Tropites* is the one most numerously represented in the limestone of Kalapani which has therefore been named the Tropites-limestone. This name having been generally accepted in Indian literature, I retain it, although there are some strong reasons in favour of discarding it.

Equivalents of the zone of *Tropites subbullatus* were not found in the sections closely examined by C. L. Griesbach and myself in 1892. Therefore it seemed most desirable that the fossiliferous localities in Byans should be revisited, and that larger collections of fossils should be made in the so-called Tropites-limestone. During the summer of 1899, F. H. Smith spent two months on geological work in Byans, following the divergent valleys of the upper Kali and Kuti Yangti rivers, confining his attention chiefly to the rocks of Mesozoic age. His work was continued by the late Dr. A. von Krafft in the summer of 1900. Upon the rich material gathered by those two officers of the Geological Survey of India the following descriptions of the fauna of the Tropites-limestone are based.

As to the sections in Byans, where this important and very interesting horizon is developed, the sequence of beds seems as yet not to have been satisfactorily established. Griesbach, in his account of the geology of the central Himálayas (Memoirs, Geological Survey of India, Vol. XXIII, p. 189), lays special stress on the difficulty of survey work in the Triassic region of Byans, where all the sections are so intensely crushed and disturbed that an exact determination of the single horizons, which lithologically resemble each other most closely, becomes almost an impossibility. Of the results of the survey work done by F. H. Smith (1899) and A. v. Krafft (1900) nothing but very short notes have been published in the General Report of the Geological Survey of India (1899-1900, p. 44, 1900-01, p. 26). From those notes we only learn that the Triassic series of Byans differs considerably from that of Johar, Painkhanda and Spiti, the beds between the lower Trias and the Tropites-limestone being reduced to 250 feet of grey limestone corresponding to the muschelkalk, the ladinic stage and the Daonella beds of the Bambanag and Shalshal cliff sections.

It is to the kindness of Mr. T. H. Holland, Director of the Geological Survey of India, that I owe the original diaries of F. H. Smith and A. von Krafft, containing summaries of their observations in Byans. From those summaries the following valuable information has been extracted for the present memoir.

I will first quote the following passages from Smith's diary :—

"My work was chiefly on a broad band of Mesozoic rocks, which traverse Byans, running from the Kalapani country in the south-east in a north-westerly direction up the Kuti-Jolinká valley. This band may be broadly described as a synclinal fold complicated by fold and thrust-faults, crushed amongst the massive Palæozoics. To the north-west it is almost a simple synclinal, and an excellent normal section is seen at Kuti from the Permian up to the upper Jurassic, but to the south-east the band gradually expands and the simple fold becomes more and more obliterated by faults until in the hills round Kalapani the section is complicated out of all recognition by recurrent thrust-faults.

"The following is a generalized section of the rocks found in Byans, with their maximum thicknesses and approximate ages, in descending order :—

			Ft.
Jurassic	Upper	1. Black Spiti shales	500
	Lower	2. Ferruginous oolitic beds	20
		3. Dark shaly clays	30
		4. Massive grey limestone	200
Trias	Upper	5. Dark limestone and shaly clays	700
		6. Flaggy limestone with shaly partings	350
		7. Reddish limestone and shales	250
		8. Greenish black shales with sandy bands	1,000
	Middle	9. Blue-grey limestone	250
	Lower	10. Chocolate limestone, shaly at base	150
Permian		11. Black Productus shales	200
Carboniferous		12. Massive white quartzite	

"The colours mentioned refer to those exhibited on weathered surfaces. The limestones are invariably blue-grey of various shades when broken.

"*Lower Trias* (10). The permian Productus shales pass up by interstratification into compact chocolate-coloured limestones. I could not find any fossils in the passage beds, and in the Kalapani district the chocolate limestone contains very few fossils. But near Kuti and Jolinka a band of 5 feet of sandy rock appears at the base of the limestone and this band and the neighbouring beds become rich in cephalopoda.

"*Middle Trias* (9). The chocolate limestone passes up somewhat abruptly into blue-grey massive limestones, the basal beds of which, two or three feet in thickness, are often composed entirely of broken crinoid stems. About 50 feet from the base there is a thin bed full of muschelkalk brachiopoda, well seen near Kalapani. Above this, but in an uncertain position due to the faulting of the rocks, a zone of muschelkalk cephalopoda is found at Jolinka. The division between middle and upper Trias is not very definite, fossils of both ages appearing to occur near the top of band 9.

"*Upper Trias. Topmost beds of band 9.* Ten feet from the top of the blue-grey limestone there is a zone some three feet in thickness, full of cephalopods of the upper Trias type. This zone is found everywhere near the top of the blue-grey limestone and it is the most prolific bed throughout the whole sequence.

"*Band 8.* The blue-grey limestone passes up through a few feet of shaly limestone into a great thickness of black splintery shales, which weather a greenish colour. They are practically unfossiliferous at Kalapani, but near Kuti they contain minute ammonites and remains of *Orthoceras*, preserved in ochreous material.

"*Band 7.* At the top of the black shales sandy calcareous bands appear, passing into very finely bedded red limestone tiles, which are intercalated with dark shales. Rare fossils (*Daonella*) are found in bands 7 and 6.

"*Bands 6 and 5.* The red limestone beds pass up gradually into a great thickness of grey limestones with shaly and flaggy beds. This series, which is over 1,000 feet in thickness, forms bold and inaccessible cliffs, wherever it occurs. The greater part is unfossiliferous, but here and there on waterworn surfaces sections of bivalves and cephalopods are seen, but these are rarely extricable.

"The very massive limestone (4) forming the top of band 5 appears to belong to the Jurassic."

It is the topmost bed of band 9 in Smith's section, which has yielded the rich fauna of the Tropites-limestone. It is important to remark that according to Smith's notes all the fossils have been collected in a single horizon of three feet in thickness only. This horizon is stated to be the richest in organic remains throughout the whole Triassic sequence and to be widely distributed throughout the district.

Smith's notes are supplemented by the following remarks, which I copy from A. von Krafft's diary :—

"The country visited in May 1900 lies to the north of the Kali and Kuti Yangti rivers. No complete normal section of Trias has been met with. Great stratigraphical interest is, however, connected with the upper Triassic beds, distinguished by a cephalopod-bearing horizon, the Tropites-limestone of Kalapani 'of former records,' which in no part of the Himálayas is known to be so well represented as in Byans.

"The Triassic series is as follows :—

6. Series of limestones not examined in detail.
5. Shales with ammonites (Halorites beds ?).
4. Grey limestone of great thickness.
3. Thick black shales.
2. Grey limestone mass, 200 to 250 feet, the topmost beds rich in Tropites, etc.
1. Chocolate-coloured limestone ; lower Trias.

"The chocolate limestones (1) contain badly preserved fossils. They most likely represent the Otoceras beds only. The grey limestone is unfossiliferous in the lowest beds, which probably are of lower Triassic (Subrobustus beds Diener) and of lower muschelkalk age. About fifty feet above the chocolate limestone (1) a band with badly preserved cephalopoda of upper muschelkalk age (*Gymnites Jollyanus* Oppel, etc.) has been traced. Immediately below this rare brachiopoda occur (horizon of *Spiriferina Stracheyi* Bittner). It is remarkable that the muschelkalk is very indifferent and only traceable with difficulty in Byans, at least this is the case near Kalapani and Tera Gádh.

"Above the bed with muschelkalk cephalopoda no fossils could be observed up to the three or four topmost beds of the blue-grey limestone with the Tropites fauna. The unfossiliferous limestones between the cephalopod-bearing horizon of the muschelkalk and the Tropites-limestone must represent the entire ladinic and lower carnic stages of Europe, as no break in the stratigraphical sequence can possibly be assumed.

"The Tropites-limestone has yielded many and very well preserved ammonites at Kalapani, Tera Gádh, Lilinthi, N. of Nali and N.-W. of Kuti. Palæontologically this fauna is very remarkable. The genus *Tropites* being very common and *Tropites subbullatus* occurring among other species, the fauna must be nearly allied in age to that of the Subbullatus-beds of the Salzkammergut. But together with these upper carnic types forms occur, which bear a strong resemblance to species known from the limestone of the Sommeraukogel near Hallstatt, considered by E. v. Mojsisovics to be of noric age. No explanation of this fact can be attempted so far.

"The shales (3) contain remains of *Arcestes*. Very few fossils have been found in the topmost beds of band 4. They resemble forms, which in Spiti occur in beds corresponding to the 'Haueritos' beds (Diener) of the Bambanag section. The shales (5) have only been observed in one section near Kalapani, where they are strongly crushed. Traces of ammonites are present, but cannot be determined. These shales are probably equivalents of the Halorites beds.

"Too much snow and lack of time as well as great disturbances of the beds account for my being unable to say anything definite about the higher Triassic and Jurassic beds."

This shows that A. von Krafft did not overlook the remarkable mixture of two different elements in the fauna of the Tropites-limestone.

As has been said above, the material for the present memoir consists of the fossils collected in the Tropites-limestone of Kalapani, Tera Gádh, Lilinthi, Nihal, Kuti and other places in Byans by F. H. Smith and A. von Krafft. Before entering into a description of the species and into a full discussion of their geological bearing, I may be allowed to make a few remarks on the method of their determination.

The successful determination of these fossils is chiefly due to the opportunity I had in Vienna of comparing them with the beautiful materials from the Triassic Hallstatt beds, which belong to the collections of the K. K. Geologische Reichsanstalt. These collections contain an overwhelming majority of the type-specimens of the magnificently illustrated memoirs of E. v. Mojsisovics, the standard work on Alpine Triassic cephalopoda. I soonfound out that I was unable to arrive at a satisfactory determination of numerous species (especially of the genus *Tropites*) with the assistance of the plates only, without having the type-specimens themselves available for comparison. I am deeply grateful therefore to Dr. E. Tietze, Director of the K. K. Geologische Reichsanstalt, for the unrestricted use of the Hallstatt collection.

The fact that the entire material of the Hallstatt beds was described by a single author, E. von Mojsisovics, was of extreme value to me, as it was thus concentrated in one place. Of course, I endeavoured to consult the publications of other authors on the subject of upper Triassic faunæ, but I soon saw that I could not rely on them. I was, indeed, disappointed to find that in Gemmellaro's recent monograph on the upper Triassic cephalopoda of Sicily (July 1904) the types are represented in a manner which defies every attempt to realise their true shape.

My wish to compare the fauna of the Tropites-limestone of Byans with that of the Tropites beds of North America proved not to be realisable, Perrin-Smith not having issued his long-promised memoir until now (December 1904).

DESCRIPTION OF FOSSILS.

Class : **BRACHIOPODA.**

RHYNCHONELLA ANGULIFRONS Bittner. Pl. XVII, fig. 11.

1890. *Rhynchonella angulifrons* Bittner, Brachiopoden der alpinen Trias, Abhandlungen K. K. Geologische Reichsanst., XIV, p. 214, Taf. VIII, figs. 23-26.

This is the only representative of the brachiopoda in the Tropites-limestone of Byans, which can be safely identified with a species from the Alpine Trias. There are two specimens in A. von Krafft's collection from Lilinthi, both of which agree very closely with Bittner's figures and descriptions of *Rhynchonella angulifrons*.

Rh. angulifrons belongs to a group of forms of which *Rh. dilatata* Suess. (Brachiopoden der Hallstätter Schichten, Denkschr. Kais Akademie der Wissensch., math. nat. Klasse, IX, 1855, p. 29) is the prototype. The very short, small and crooked beak and the absence of ribs are good characters of this species, whereas the broadly-expanded sinus is extremely variable in its shape and development.

The two specimens from the Himálayas are most nearly allied to the variety from the Roethelstein, which has been illustrated by Bittner on Pl. VIII, fig. 25. They are broad and provided with a flat sinus, which does not reach into the visceral region of the valve. The front line is not perfectly symmetrical and exhibits three small plications, to which, however, no distinct folds correspond in the tongue of the sinus.

My specimens belong to the variety with quadrangular outlines. The lateral parts unite with the front in sharp angles. This feature is considered by Bittner to be a character of distinction between *Rhynchonella angulifrons* and *Rh. dilatata*.

In its dimensions my type-specimen agrees almost perfectly with the example from the Roethelstein figured by Bittner. Its measurements are as follows :—

Entire length of the shell	15 mm.
Length of the dorsal valve	14 „
Entire breadth of the shell	16 „
Thickness of both valves	9 „

To this specimen my second example is considerably inferior in thickness, but is still more broadly expanded.

In the Alpine Trias the group of *Rhynchonella dilatata* seems to be characterized by a rather wide stratigraphical distribution. Specimens of the typical *Rh. dilatata* and of *Rh. angulifrons* have been quoted by Bittner both from the carnic and noric Hallstatt limestones of the Salzkammergut. In the zone of *Tropites subbullatus* of the Sandling they are very common.

Class : GASTEROPODA.

LOXONEMA sp. ind. Pl. XVII, fig. 6.

Gasteropoda are exceedingly rare in the collections from the Tropites limestone of Byans. Only two specimens of turreted shells are known to me. One of them is a fragmentary cast. The second is more complete and has its shelly substance partly preserved. But the apex has been broken off and the aperture is not accessible to examination, being filled up with a tough matrix, which resisted all my attempts to remove it.

Among the numerous types of gasteropoda from the Triassic Hallstatt beds, illustrated by Koken (Die Gastropoden der Trias um Hallstatt, Abhandl. K. K. Geologische Reichsanst, Bd. XVII, 1897) it is the genus *Loxonema* Phill., to which this specimen is most closely allied. I shall, of course, not venture to enter upon the question, whether the Triassic species referred to *Loxonema* ought or ought not to be excluded from the group of *L. sinuosum*, which must be considered as the prototype of the genus. I only wish to state that among the species referred to *Loxonema* by Koken some exhibit a greater affinity to my Himalayan specimen than any of the Triassic gasteropoda from the Marmolata, Hallstatt and Esino limestones. It recalls especially *L. fuscum* Koken (l. c., p. 95, Pl. XV, fig. 8) in its small size, in its flatly-arched whorls and deep sutures, and in the nearly smooth surface of its upper whorls.

The surface of the last whorl is provided with shell. The shell is covered with numerous longitudinal striæ of unequal strength, which do not consist of a series of interrupted grooves, but form continuous spiral lines. No traces of lines of growth have been noticed.

The absence of any transverse plications in the whorls next to the apical region precludes an identification with the genus *Heterocosmia* Koken.

No measurements can be given on account of the fragmentary character of my specimen. Nor is the latter sufficiently well preserved to admit of specific determination.

The specimen here described comes from the Tropites-limestone of Kalapani.

Class: LAMELLIBRANCHIATA.

HALOBIA cf. FASCIGERA Bittner. Pl. XVII, figs. 9, 10.

1899. *Halobia fascigera* Bittner, Trias Brachiopoda and Lamellibranchiata. Himalayan Fossils, Palæontologia Indica, ser. XV, Vol. III, Pt. 2, p. 45, Pl. VII, fig. 15.

Specimens of *Halobiæ* from the group of *H. rugosa* occur in the Tropites-limestone of Byans, but have been found in fragments only. I have succeeded in freeing from the rock only a small number of types suitable for further inquiry and for illustration.

The majority of my specimens agree very closely with *Halobia fascigera* Bittner from the lower layers of the so-called Daonella beds in the Bambanag section. The specimen illustrated in fig. 9 is a good example of this type. It exhibits the characteristic bundle-shaped arrangement of the middle ribs, which has been described by Bittner. This complicated division of the ribs occurs in the vicinity of the umbo. The ribs are more or less markedly undulating throughout their whole extent. In the specimen just described the ribs are a little less coarse than in Bittner's type-specimen of *Halobia fascigera*, although considerably more so than in *H. rugosa*. From *H. rugosa* all my specimens differ not only by the distinctly ribbed umbonal region, noticed by Bittner, but also by their flattened shape. As in the majority of congeneric forms the deep intercostal furrows and not the ribs are the principal elements of sculpture, whereas in *H. rugosa* the ribs are not flattened but acute, as has been remarked by E. v. Mojsisovics.

In the bundle-like arrangement of the middle ribs this group of Himálayan *Halobiæ* resembles *Halobia Suessi* E. v. Mojsisovics (Ueber die triadischen Pelecypoden Gattungen *Daonella und Halobia*, Abhandlg. K. K. Geologische Reichsanst., Vol. VII, p. 26, Taf. V, fig. 12, 13). This species is, however, distinguished by straight ribs, which are not at all undulating.

In my specimen, illustrated in fig. 91, a marked concentric angle in the ribs between the umbonal and the pallial portions of the shell does not exist, and the wrinkling of growth is only faintly developed. There are, however, other types of this group of *Halobiæ* in the Himálayan collection, in which those two characters are very distinctly marked.

A character in which the figured specimen does not entirely agree with Bittner's *H. fascigera* is the shape of the anterior ear. This is wide, and separated from the adjacent shell by a very sharp furrow, but is nearly smooth and exhibits but indistinctly the division into a low and narrow outer and a strongly elevated, wide inner portion, as is the case in Bittner's type-specimens. Nor is it affected by the coarse umbonal sculpture.

Associated with this form there occurs an isolated specimen of *Halobia*, in which the ear is perfectly smooth and is more distinctly separated from the visceral portion of the valve than in Bittner's type-specimens of *H. fascigera*. There is, however, no division of the ear into two regions of different height, but the ear is perfectly level. On the other hand, the shape and sculpture of this specimen agree exactly with those of the typical *Halobia fascigera*. The ribbing is rather coarse. The umbonal region of the valve is fairly high and regularly inflated, the marginal part, however, is almost perfectly flat. To the boundary of the two regions a sharp angle in the direction of the middle ribs corresponds, which is caused by the interruption of growth. The concentric wrinkles of growth are especially well marked in the vicinity of the umbo.

This specimen, represented by a left valve, has been illustrated in fig. 10. I consider it, provisionally, as a variety of *Halobia fascigera*. Our knowledge of the group is still too limited to burden palæontological nomenclature with the introduction of new specific names for such insufficiently preserved material. My specimens, however, prove that the group of *Halobia rugosa* is rather widely distributed in the upper Trias of the Himálayas.

HALOBIA cf. COMATA Bittner.

1899. *Halobia comata* Bittner, Trias Brachiopoda and Lamellibranchiata. Himálayan Fossils, Vol. III, Pt. 2, Palæontologia Indica, ser. XV, p. 46, Pl. VII, fig. 13.

Halobia comata has been included by Bittner, as is well known, among the most characteristic species of the group of *H. rugosa* from the upper Triassic rocks of the Himálayas. Among the collections of F. H. Smith from the Tropites-limestone of Nihal there are three fragmentary specimens of a *Halobia*, which I should hesitate to separate from *H. comata*. Their shells are covered with very numerous and thin acute ribs, as in *H. rugosa*, but reaching nearer to the umbo. The undulating character of the ribs is but indistinctly marked.

With Bittner's type-specimen my examples agree in the absence of any marked concentric angle in the ribs, between the umbonal and pallial parts of the shell. Concentric wrinkles of growth are less distinctly developed than in *H. rugosa*.

The anterior ear has not been preserved in any of my specimens. Their poor state of preservation renders them unfit for illustration.

AVICULA sp. ind. aff. A. TOFANÆ Bittner. Pl. XVII, fig. 7.

The genus *Avicula* appears to occur in some quantity in the Triassic Tropites-limestone of Kalapani. In A. v. Krafft's collections there are several left valves of *Aviculæ*, in a rather imperfect state of preservation. Two specimens are figured on account of their affinity to Alpine species.

The specimen illustrated in fig. 7 is a cast, with remnants of the shell adhering in the vicinity of the anterior wing. The posterior part of the valve has been partly broken off.

This specimen agrees very closely in dimensions, outlines and general characters with *Avicula Tofanæ* Bittner (Lamellibranchiaten der alpinen Trias, I. Theil. Revision der Lamellibranchiaten von St. Cassian, Abhandl. K. K. Geolog. Reichsanst., Bd. XVIII, p. 71, Taf. VIII, fig. 9, 10, 11). This species is distinguished from the congeneric forms of the St. Cassian strata by its considerable height, which is equal to the length of the valve and even slightly surpasses that of the hinge-line. This character is very well developed in the Himálayan specimen. The valve is flatly arched. The wings are not marked off sharply from the visceral portion of the shell. There is no sinus in the posterior wing.

The examples from the Pachycardia beds of the Seiser Alpe, which have been identified with *A. Tofanæ* by Broili (Palæontographica, Vol. L, 1903, p. 165, Taf. XVII, fig. 20), are more strongly vaulted than Bittner's type-specimen and my Himálayan shell. The specimen figured by Broili is still higher and in this character approaches the extreme type of the genus *Avicula Kokeni* v. Woehrmann (Zeitschr. Deutsch. Geolog. Ges. 1892, Taf. VIII, fig. 9, p. 175). The antero-posterior axis is consequently less oblique than in the Himálayan species.

Although my specimen is too incomplete to justify an identification with *A. Tofanæ*, its close affinity to this Alpine species is not without interest.

AVICULA sp. ind. aff. A. CAUDATA Stoppani. Pl. XVII, fig. 8.

The second representative of the genus *Avicula* in the Tropites-limestone of Kalapani, which exhibits a close affinity to an Alpine species, is the cast of a left valve, entirely devoid of shell though otherwise tolerably well preserved. Its hinge-apparatus is not accessible to observation.

This specimen is characterised by its strongly oblique shape and, in this respect, recalls *A. caudata* Stopp. from the Esino limestone. It is most nearly related to the specimen figured by Bittner on Pl. VIII, fig. 18, of his revision of the St. Cassian lamellibranchiata (Abhandl. K. K. Geol. Reichsanst., Bd. XVIII). From the type-specimen of *A. caudata* illustrated by Stoppani (Palæontologie Lombarde, Ière ptie, Pétrifications d'Esino, Pl. XVIII, fig. 18, 19) it differs by its moderately elevated visceral region, whereas the examples from the Triassic limestone of Esino are thick and strongly vaulted. The posterior wing is but slightly sinuated.

Avicula decipiens Salomon (Geologische und Palæontologische Studien über die Marmolata, Palæontographica, XLII, 1895, p. 152, Taf. IV, fig. 36-39) is also very closely allied to my Himálayan specimen, although none of the right valves figured by Salomon attain its size. Bittner considers this species to be identical with *A. caudata.* In this opinion he is supported by Broili (Palæontographica, Vol. L, p. 165), who figured a few specimens from the Pachycardia beds of the Seiser Alpe. They are, however, far inferior in size to my Himálayan specimen, which agrees more closely with the above-mentioned example described and figured by Bittner.

As I have not succeeded in making the hinge apparatus visible in any of my pecimens, they cannot be definitely proved to belong to the genus *Avicula*. I do not think, however, that their relegation to that genus will be seriously questioned. The only other genus, which might be taken into consideration, is *Gervillia*. But among the Triassic types of this genus there are none, which in external characters approach my Indian examples as closely as the two above-quoted species of *Avicula*.

Class : CEPHALOPODA.

Order : DIBRANCHIATA.

Family : *BELEMNITIDÆ.*

Genus : ATRACTITES Guembel.

ATRACTITES cf. ELLIPTICUS Mojsisovics. Pl. XVIII, fig. 4.

1871. *Aulacoceras ellipticum*, E. v. Mojsisovics. Ueber das Belemnitidengeschlecht *Aulacoceras* Jahrb. K. K. Geol. Reichsanst. XXI, p. 55, Taf. II, fig. 9.

1902. *Atractites ellipticus*, E. v. Mojsisovics. Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geo. Reichsanst. VII, Supplementband, p. 196, Taf. XV, fig. 5.

This species is represented by a single phragmocone, agreeing very closely with the type-specimen from the Triassic Hallstatt beds of the Roethelstein. Its transverse section is of strongly elliptical outlines, the angle of divergence along the ventral and dorsal parts being considerably less acute than along the lateral parts. Septa close to each other, forming flat saddles across the dorsal and ventral sides and corresponding lobes across the flanks.

Siphuncle standing very close to the ventral margin and strongly inflated in the interseptal spaces in such manner as to recall a string of pearls. This inflated character of the siphuncle in the interseptal spaces is considered as a good specific feature of distinction by E. v. Mojsisovics.

The only point in which my Himálayan specimen does not agree exactly with the European type, is the distance of the septa near the apex of the phragmocone. In the Alpine type-specimen figured by E. v. Mojsisovics this distance decreases more rapidly in proportion to the ventro-dorsal diameter of the septa than in the Indian form. Otherwise I should not be able to separate the two specifically.

The length of the phragmocone as far as preserved is 65 mm. To this length a ventro-dorsal diameter of 44 mm. and a lateral diameter of 34 mm. correspond. The distance of the two last air-chambers is 8 mm.

Angle of divergence 20° along the ventro-dorsal, 17° along the lateral parts, of the phragmocone.

Fragments of the shell adhering to the phragmocone are entirely smooth, thus proving that it belongs to the genus *Atractites*, not to *Aulacoceras*.

Atractites giganteus Gemmellaro (I cefalopodi del Trias superiore della regione occidentale dela Sicillia, Palermo, 1904, p. 303, Taf. XXVI, fig. 15) from the upper Triassic grey limestone of Castronuovo and Santo Stefano Quisquina in Sicily seems to be very closely allied to this species. The phragmocone of Gemmellaro's type and that of the present specimen are of the same length, 65 mm., but a larger portion of the apical region is missing in the former. This phragmocone is provided with an elliptical transverse section measuring 51 mm. along its ventro-dorsal and 42 mm. along its lateral diameter. The distance of the two last air-chambers is 9 mm. The chief difference probably consists in the smaller ventro-dorsal angle of divergence, which is only 18½° in *A. giganteus*. I feel, however, considerable uncertainty as to whether this insignificant difference should really be regarded as of specific importance. The propriety of admitting *A. giganteus* as a new species is, indeed, questionable, and its specific claims will be the subject of justifiable difference of opinion.

2. ATRACTITES cf. CONVERGENS Hauer. Pl. XVIII, fig. 5.

1847. *Orthoceras convergens* F. v. Hauer, Neue Cephalapoden von Aussee, Haidinger's Abhandl. Bd. I, p. 259, Taf. VII.

1849. *Orthoceratites alveolaris conicus* Quenstedt, Cephalopoden, p. 477, Taf. 31, fig. 6.

1871. *Aulacoceras convergens* E. v. Mojsisovics, Über das Belemnitidengeschlecht *Aulacoceras*, Jahrb. K. K. Geol. Reichsanst. Bd. XXI, p. 54.

1902. *Atractites convergens* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI—1, Supplement, p. 196, Taf. XVI, fig. 1.

A very large phragmocone from the Tropites-limestone of Kalapani (coll. Smith) differs from the specimen, which has been compared with *A. ellipticus* in the preceding description, by the same characters which have been noticed by E. v. Mojsisovics as features of distinction between *A. ellipticus* and *A. convergens*.

In the Himálayan phragmocone to a length of 53 mm. a ventro-dorsal diameter of 38 mm. and a lateral diameter of 36 mm. correspond in the transverse section. This transverse section is therefore much less strongly elliptical than in *A. ellipticus*. The angle of divergence is 22° along the ventro-dorsal and 20° along the lateral parts.

The septa are very strongly convex and close to each other, their distance being equal to one-fourth of the lateral diameter of the lower air-chamber. The siphuncle is almost as strongly inflated along the interseptal spaces as in *A. ellipticus*. In this respect my specimen seems to differ from the Alpine type, the siphuncle of which is, according to the description of E. v. Mojsisovics, only very slightly inflated. The illustration on Pl. XVI, fig. 1, however, shows that the siphuncle is considerably inflated along the interseptal spaces, though perhaps not as strongly as in *A. ellipticus*. The shell adhering in large fragments to the cast along the ventral sides is perfectly smooth. I have been unfortunately obliged to destroy it almost completely in order to render the siphuncle accessible to observation.

Order : NAUTILOIDEA.

Family : *ORTHOCERATIDÆ.*

Genus : ORTHOCERAS Breynius.

The genus *Orthoceras* is rather largely represented in the Himálayan collections of Smith and A. v. Krafft, but the overwhelming majority of examples are fragments of air-chambers or body-chambers unfit for determination. Nearly all my specimens belong to the group of *Orthocerata lævia.* There is only one single fragmentary specimen of which the shell is covered with delicate striæ, thus justifying its inclusion in the group of *Orthocerata striata.*

1. ORTHOCERAS cf. TRIADICUM Mojsisovics. Pl. XVII, fig. 3.

1873. *Orthoceras triadicum* E. v. Mojsisovics, Cephalopoden der Hallstaetter Kalke, Abhandl. K. K. Geol. Reichsanst. VI—1, p. 4, Taf. 1, figs. 2, 3.

The fragments of *Orthocerata lævia* in the Himálayan collection, chiefly from the Tropites-limestone of Tera Gádh, Kalapani and Lilinthi, belong probably to two different Triassic species, *O. triadicum* and *O. dubium.*

E. v. Mojsisovics quotes as characters of distinction between these two species the long body-chamber and the small angle of divergence in *O. triadicum.* The most complete of all my numerous examples of *Orthocerata lævia* exhibits those features specially clearly, and if the identification with the Alpine species is here made with some reservation, the reason for this is to be sought in the scanty material available for examination.

2. ORTHOCERAS cf. DUBIUM Hauer.

1847. *Orthoceras dubium* F. v. Hauer, Neue Cephalopoden von Aussee. Haidinger's Abhandl. I, p. 260, Taf. VII, figs. 3, 4, 6, 7, 8.

1873. *Orthoceras dubium* E. v. Mojsisovics, l. c. Abhandl. K. K. Geol. Reichsanst. VI—1, p. 1, Taf. 1, figs. 4, 5.

1904. *Orthoceras cf. dubium* Gemmellaro, I cefalopodi del Trias superiore della parte occidentale della Sicilia, p. 4.

Together with *Orthoceras triadicum* Mojs. fragments of *Orthoceras* have been met with, which are distinguished from the preceding species by a somewhat larger angle of emergence. These fragments, in which the diameter of the transverse section increases more rapidly in proportion to the length of the cone, might be referred provisionally to *O. dubium* Hauer.

Among my materials there is no example fit for illustration.

3. ORTHOCERAS sp. ind. (group of *O. striata*).

There is a single fragment of *Orthoceras* with a striated shell present in A. v. Krafft's collection from Lilinthi. It is, however, impossible to name the species.

Family: *NAUTILIDÆ.*

Sub-Family: GRYPONAUTILIDÆ.

Genus: Grypoceras Hyatt.

Grypoceras sp. ind. aff. mesodico Hauer. Pl. XVII, fig. 1.

There is a fragment of a large *Nautilus* from the Tropites-limestone of Kalapani (coll. Smith), which probably belongs to the genus *Grypoceras* Hyatt (Proc. Boston Soc. of Nat. History, Vol. XXII, p. 269).

My fragment consists of the last air-chambers and of the beginning of the body-chamber, comprising but little more than the third part of one single volution. The inner whorls, which have been partly destroyed by weathering, are hidden by the last volution, embracing them almost entirely and leaving only a narrow and deep umbilicus, surrounded by a nearly perpendicular wall. The transverse section is very broad, considerably broader than high. Both the lateral and siphonal parts are flattened and separated by rounded-off marginal edges.

Siphuncle central or slightly subcentral.

The sutural line consists of a flat and broadly-extended siphonal lobe and of a large lateral lobe which occupies the entire flank. The small siphonal saddle corresponds exactly to the rounded-off demarcation between the siphonal and lateral parts I have succeeded in developing a deep, annular internal (antisiphonal) lobe.

The measurements of the transverse section are as follows:—

Height above the umbilical suture	32 mm.
„ „ „ preceding volution	22 „
Thickness	46 „

The present fragment is certainly more nearly allied to the Alpine *Grypoceras mesodicum* v. Hauer (Cephalopoden des Salzkammergutes, p. 36, Taf. X, fig. 4-6) than the species from the Halorites limestone of the Bambanag range, which E. v. Mojsisovics has described as *Nautilus f. ind. ex aff. N. mesodici* (Palæontologia Indica, ser. XV, Himálayan Fossils, Vol. III. Pt. 1, p. 122, Pl. XXI, fig. 2). This Himálayan species, which has since been elevated to the rank of a subgenus *Indonautilus* (Abhandl. K. K. Geolog. Reichsanstalt, VI—1, Supplementband, p. 205), has no internal lobe and must consequently belong to a different family to the *Gryponautilidæ.* The species here described seems to be a true *Grypoceras,* agreeing with *G. mesodicum,* the prototype of the genus, in the character of its sutural line. In its specific features it is, however, remarkably different from the Alpine type. Its very broad siphonal area, the absence of blunt marginal edges and the more concentrated involution distinguish it from *G. mesodicum* at the first glance. Its imperfect state of preservation does not permit a more detailed comparison.

Sub-family : CLYDONAUTILIDÆ.

Genus : PROCLYDONAUTILUS Mojsisovics.

PROCLYDONAUTILUS GRIESBACHIFORMIS nov. sp. Pl. XVII, fig. 2.

My collection contains five specimens—four from Lilinthi (coll. Krafft) and one from Tera Gádh (coll. Smith)—belonging to this species, which is very closely allied to *Proclydonautilus Griesbachi* E. v. Mojsisovics (Palæontol. Indica, ser. XV, Himálayan Fossils, Vol. III, Pt. 1, p. 123, pl. XXII, fig. 1) from the Haucrites beds of the Bambanag section.

My largest specimen is chambered throughout at a diameter of 80 mm. In a second example with a diameter of 67 mm. one-third of the last volution belongs to the body-chamber. This is also the case in the figured type-specimen attaining a diameter of only 48 mm.

From *Proclydonautilus Griesbachi* this species is distinguished by the presence of sharp marginal angles, which separate the siphonal area from the lateral parts. These sharp edges make their appearance in an early stage of development. In the figured specimen they are distinctly marked at the very beginning of the last volution, corresponding to a height of only 10 mm. Another distinguishing feature in contrast to *P. Griesbachi* is the shape of the siphonal area. This is narrower and not inflated except in the adolescent stage of growth, whereas in later stages of development it turns perfectly flat and even concave. The aperture of the figured specimen exhibits the deeply-excavated siphonal area bordered by the sharp marginal edges, which recall the blunt keels of *Norites* Mojs.

The transverse section is very similar to that of *P. Griesbachi* or of *Clydonautilus biangularis* Mojs. The lateral parts converge towards the siphonal area, the shell reaching its greatest transverse diameter in the vicinity of the umbilical margin. There is no umbilical edge present, but the flanks descend in a strongly bent curve from the region of the greatest lateral inflation to the umbilical suture.

All my specimens being casts with only fragments of the shell adhering, I cannot decide the question, whether or not the umbilicus was closed by a callosity.

The sculpture consists of faint transverse folds, similar to those in *Clydonautilus*

Siphuncle.—The position of the siphuncle is subcentral in the inner volutions, but is gradually shifted in the direction of the siphonal area in later stages of growth, thus becoming central and situated even above the middle of the distance between the external parts of the penultimate and last whorls.

Sutures.—In the arrangement of the sutural line this species agrees with

P. Griesbachi. A broadly-rounded lateral saddle, which is followed by a flat auxiliary lobe, corresponds to the region of the greatest transverse diameter. Across the flanks a broad lateral lobe ascends to a small siphonal saddle, the top of which is divided by the marginal edge. The siphonal lobe is short and nearly angular, its two borders uniting in a blunt angle. There is not the faintest trace of a median prominence present. The species must, consequently, be classed among the subgenus *Proclydonautilus* Mojsisovics (Abhandl. K. K. Geolog. Reichsanst., VI—1, Supplement, p. 207), from which the true representatives of the genus *Clydonautilus* differ by the development of a distinct median prominence.

Dimensions.

Diameter of the shell	48 mm.
„ „ „ umbilicus (cast)	2 „
Height of the last volution { above the umbilical suture	28·5 „
Height of the last volution { „ „ preceding whorl	21 „
Thickness of the last volution	21 „

Remarks.—Whether the present species ought to be regarded as the direct ancestor of *Proclydonautilus Griesbachi*, is questionable. In *P. Griesbachiformis* the external features of *Clydonautilus biangularis* are combined with the sutural line of *P. Griesbachi*. In the development of sharp marginal angles our species seems to be allied to *Proclydonautilus nov. f. ind.* Mojsisovics (Himálayan Fossils, Pal Indica, ser. XV, Vol. III, Pt. 1, p. 125) from the Daonella beds of Lauka. An identification with the latter species is, however, excluded by the description of E. v. Mojsisovics, which includes a strongly-inflated siphonal area among its distinctive features.

Order: AMMONOIDEA.

AMMONEA TRACHYOSTRACA.

A. Ceratitoidea (Trachyostraca Brevidoma).

Family: *DINARITIDÆ.*

Genus: Ceratites de Haan.

Subgenus: *Helictites* Mojsisovics.

The subgenus *Helictites* is represented in the fauna of the Tropites-limestone of Byans by four species, three of them agreeing so closely with European types that I did not feel justified in keeping them separate by the introduction of new specific denominations.

HELICTITES cf. GENICULATO Hauer. Pl. VIII, fig. 15.

1855. *Ammonites geniculatus* F. v. Hauer, Beitraege zur Kenntniss der Cephalopodenfauna der Hallstätter Schichten. Denkschr. Kais. Akad. d. Wiss. Wien, math. nat. Kl. Bd. IX. p. 153, Taf. V. fig. 21-23.

1893. *Helictites geniculatus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst, VI—2, p. 417, Taf. CXXXIX, fig. 6-8.

A specimen from the Tropites-limestone of Nihal agrees very closely with *Helictites geniculatus* from the Triassic limestone of the Leisling of lacic (lower noric) age.

It is provided with its body-chamber and is equal in size to the specimen illustrated in fig. 8 by E. v. Mojsisovics. The very slowly increasing whorls envelop each other only very slightly, leaving open a wide umbilicus. The transverse section is of almost equal height and thickness and of trapezoidal shape. The greatest transverse diameter corresponds to the umbilical margin. The siphonal margin is angular, the flatly vaulted external area uniting with the lateral parts in a right angle.

The sculpture of the last volution agrees with that of the typical form of *H. geniculatus.* It consists of numerous slightly curved ribs, whose concavity is turned forward anteriorly. The ribs are either simple or originate in pairs from radially elongated umbilical tubercles. The siphonal margin is marked by a row of knot-like swellings. The ribs cross the siphonal area and even attain their greatest development along the median line of the cast. It is only in the vicinity of the aperture that these swellings of the ribs in the middle of the external area cease. The intercostal furrows are but very little wider than the ribs.

The only difference between the ornamentation of the present and that of the European form is the more delicate character of the sculpture in our specimen, which in this respect very closely approaches the variety illustrated in fig. 7 by E. v. Mojsisovics. With this variety our specimen also agrees in the development of delicate ribs on its inner volutions. The typical form of the Alpine *H. geniculatus* has its inner volutions covered with a small number of strong radial ribs separated by broad intercostal spaces. In my Himalayan specimen the sculpture of the last volution persists on the inner whorls so far as they are accessible to examination.

I should not have hesitated in considering this a distinctive character of specific value between the European and Indian forms, if E. v. Mojsisovics himself had not united the small specimen, illustrated in fig. 7, with *H. geniculatus*. My Himalayan example certainly does not differ from the type in more important details than this specimen. I consequently prefer to class it with *H. geniculatus* as "*cf. geniculato,*" referring it provisionally to that species, to which it is certainly most closely allied.

Dimensions.

Diameter of the shell	21 mm.
" " " umbilicus	9 "
Height } of the last volution	6 "
Thickness } of the last volution	7 "

Sutures.—Not known.

2. HELICTITES cf. SUBGENICULATO Mojsisovics. Pl. VIII, fig. 16.

1893. *Helictites subgeniculatus* E. v. Mojsisovics. Die Cephalopoden der Hallstätter Kalke. Abhdl. K. K. Geolog. Reichsanst., VI—2, p. 419, Taf. CXXXIX, fig. 9.

It is with considerable hesitation that I refer a single incomplete specimen from the Tropites-limestone of Tera Gádh (coll. Smith) to this Alpine species, but it appears to correspond better with the characters assigned to that species by E. v. Mojsisovics than with those of any other. It is rather unfortunate that the species was also founded by E. v. Mojsisovics on a single imperfect specimen.

The subgenus *Helictites* is distinguished by the presence of straight transverse ribs crossing the external area without any interruption. Now in my specimen the siphonal part has been strongly injured by weathering and it is only near the beginning of the last volution that traces of external ribs which pass across the siphonal area, have been noticed. This observation allows the specimen to be placed in the subgenus *Helictites* Mojs., though with the reservation demanded by the circumstances of the case.

The specimen is provided with a part of its body-chamber, to which less than one-half of the last volution belongs. The transverse section is nearly rectangular and of almost equal height and width. Near the aperture the largest transverse diameter is situated a little below the middle of the height, but in the chambered portion of the cast it corresponds to the strongly developed marginal tubercles, exactly as in the European type-specimen from the noric Hallstatt-limestone of Goisern. The siphonal area is flatly rounded and separated from the flanks by a distinct marginal edge. There is no distinct umbilical edge present, but the lateral parts slope gradually towards the umbilical suture.

The predominating elements of sculpture are robust, button-shaped tubercles, which are set in two rows, one along the umbilical and the other along the marginal region. It is only in the immediate vicinity of the aperture that the straight or slightly forward-turned ribs connecting those tubercles become more important. In the meantime the intercostal spaces, which in the inner volutions and in the posterior portion of the last whorl are rather broad, become narrower and the ribs approach each other more closely. The same type of gerontic variation has been noticed in the Alpine specimen by E. v. Mojsisovics.

E. v. Mojsisovics noticed the absence of external ribs on the inner volutions of his type-specimen. Even near the beginning of the last whorl, he says, the transverse ribs, which connect the marginal tubercles of the two halves of the shell, are but faintly indicated. Broad, transverse, external ribs are not developed before the body-chamber is reached. With this diagnosis, which my personal examination of his type-specimen has proved to be correct, the presence of faintly developed external ribs near the beginning of the last volution in my Himalayan specimen agrees. The sculpture of its body-chamber has, unfortunately, been destroyed by weathering on the external area.

Dimensions.

Diameter of the shell	20 mm.
" " " umbilicus	8·5 "
Height } of the last volution	7 "
Thickness } of the last volution	8 "

Sutures.—The sutural line of the Alpine *H. subgeniculatus* is unknown. In my specimen the ceratitic sutures are well preserved. Siphonal lobe deep, but little shorter than the principal lateral lobe, and divided by a median prominence, rounded above and with unbroken margins. Each wing of the siphonal lobe terminates in a single sharp point.

The principal lateral lobe is the deepest. At its base a few sharp denticulations can be seen with a magnifying glass. The second lateral lobe is bifid and widens considerably towards its upper part.

Saddles entire, with rounded tops. The siphonal saddle is the largest and considerably higher than the principal lateral saddle. The second lateral saddle is divided by the umbilical suture.

3. HELICTITES sp. ind. aff. BENECKEI Mojs. Pl. VIII, fig. 14.

I am acquainted with but one single incomplete though well preserved specimen, from the Tropites-limestone of Kalapani (coll. Smith), which is very closely allied to *Helictites Beneckei* Mojsisovics (Abhandl. K. K. Geol. Reichsanst., VI-2, p. 416, Taf. CXXXIX, fig. 1) from the noric Hallstatt-limestone of Goisern.

The specimen agrees in its involution with the European type but is of obliquely elliptical outlines. I am, however, doubtful as to the specific value of this character, which to me appears to be rather accidental only. The slowly increasing whorls overlap each other to a very small extent only, leaving open a wide umbilicus. The transverse section is high and rectangular, with rounded-off angles. Both the siphonal and umbilical margins are sharply rounded. The umbilical wall is steep but low. The siphonal area is gently vaulted. The lateral parts are flat, their greatest transverse diameter corresponding to the umbilical margin.

The transverse sculpture is strongly developed, especially so on the lateral parts of the inner volutions. Broad, radial ribs rise in pairs from elongated umbilical tubercles. In the last volution the umbilical tubercles gradually disappear; the ribs become flexuous and are slightly turned towards the anterior region. Besides these dichotomising ribs originating in pairs from umbilical tubercles, numerous simple and intercalated ribs are developed in the last volution. A small number of ribs are confined to the marginal region and do not reach the lower portion of the flanks.

While the transverse sculpture of the lateral parts diminishes in strength on the last volution, the ornamentation of the siphonal area increases in importance. The ribs crossing the external part in an uninterrupted curve become expanded and elevated along the median line of the shell. They distinctly show the character of direct imbrication, their anterior slope being much steeper than the opposite one. This external sculpture is most strongly developed in the last volution, where the lateral sculpture diminishes in strength. At the beginning of the penultimate whorl there are but faint indications of its presence. The intercostal furrows are broader than the ribs in the last volution, whereas in the inner ones the reverse is the case.

Traces of marginal or lateral tubercles are entirely absent.

In its general character this sculpture shows a very close agreement with *Helictites Beneckei*. A difference is to be found in the absence in the Himalayan specimen of such ribs as terminate near the siphonal margin and do not pass across the external area. E. v. Mojsisovics remarked the presence of such ribs in his Alpine *H. Beneckei*. I have failed to discover any on the illustration of his type-specimen, but they are clearly visible on the specimen itself, as I know from personal examination.

Another difference consists in the strong development of the umbilical tubercles in the inner volutions of the Himalayan species, which on account of all those features—subordinate details, it is true—cannot be identified with *H. Beneckei.*

Dimensions.

Diameter of the shell	about 34 mm.
" " " umbilicus	14 "
Height } of the last volution	11·5 "
Thickness } of the last volution	10 "

Sutures.—Of the sutural line only very imperfect traces have been preserved, and are not fit for description.

4. HELICTITES CANNINGI nov. sp. Pl. VI, fig. 10.

This species is distinguished from all other congeneric forms by the great variation of sculpture on its last whorl and inner volutions. It is represented by a single but perfectly preserved specimen from Kalapani (coll. Smith) which is provided with its body-chamber.

In general shape and involution it recalls *Helictites Beneckei* Mojs. or *H. geniculatus* Hauer, but is of slightly elliptical outlines. The widely umbilicated shell consists of slowly increasing whorls, which are a little higher than broad and envelop each other on the rounded external part only. The umbilical margin is marked by a strong curve in the slope of the lateral parts, but no umbilical wall is present.

In the inner volutions the siphonal area is broad, very gently arched, and separated from the lateral parts by a distinct, obtusely rounded marginal edge. But in the last volution this marginal edge gradually disappears, the siphonal part becomes more strongly rounded and passes into the flanks without any distinct demarcation.

This variation in shape from the inner volutions to the body-chamber whorl is accompanied by a still more remarkable variation in sculpture. The sculpture of the inner volutions is very robust, consisting of massive umbilical and marginal tubercles, which are connected by low transverse ribs. These ribs are either simple or dichotomous, two diverging ribs originating from the same umbilical tubercle. The marginal tubercles on both sides of the shell are connected by broadly expanded external ribs, which are especially well developed near the beginning of the last volution.

On the last volution the sculpture changes rather abruptly. The umbilical tubercles are smaller and are transformed into radially protracted prominences. The marginal tubercles disappear completely. The ribs become more crowded and flexuous. In the meantime an arrangement into fasciculi is noticed, one primary rib being accompanied by three weakened secondary costæ. This arrangement of irregularly alternating ribs is especially well marked on the external part, where the difference in strength between the primary and secondary ribs is most prominent.

Dimensions.

Diameter of the shell	27 mm.
,, ,, umbilicus	10 ,,
Height } of the last volution	9 ,,
Thickness } of the last volution	8 ,,

Sutures.—Not known.

Subgenus: *Phormedites* Mojsisovics.

1. Phormedites fasciatus Mojsisovics. Pl. V, fig. 7.

1893. *Phormedites fasciatus* E. v. Mojsisovics, die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI—2, p. 428, Taf. CXLIV, fig. 6.

A specimen from the Tropites-limestone of Tera Gádh (coll. Smith) agrees perfectly with ***Phormedites fasciatus*** from the noric Hallstatt-limestone of the Sommeraukogel. The very characteristic ornamentation of the Alpine species is so faithfully repeated by the sculpture of the Himálayan specimen, that there can be no doubt about their absolute identity.

The whorls increase slowly and overlap each other to the extent of less than one-third of their height. The umbilicus is very broad and flat. The volutions are strongly compressed, with almost rectangular cross-sections, and bordered by flat lateral parts and by an equally flat siphonal area. The siphonal area is provided with a slightly elevated median band at the beginning of the last volution. This band or zone gradually dies out and is replaced by a thread-like depression in the vicinity of the aperture. Neither the elevated band nor the corresponding depression effect any interruption of the sculpture.

The lateral parts are separated from the siphonal area by a sharply rounded-off margin but slope regularly towards the umbilical suture without forming any umbilical edge.

In the ornamentation of this specimen the arrangement of slightly falciform ribs into fasciculi is most clearly marked. The innermost volutions are nearly smooth. On the surface of the penultimate volution faintly elevated bumps or broad costæ are noticed, which are separated by low intercostal depressions. In the last volution the sculpture consists of broad plications, which are turned forward towards the siphonal margin and, at the same time, considerably increase in width, whereas near the umbilical suture they terminate in sharp points. Each of these plications is ornamented with two or three delicate ribs, which originate at the umbilical suture and gradually diverge in the direction of the siphonal margin, thus imitating the arrangement of rays in a fan. On the external area the plications from both sides unite in a short lappet, with its convexity turned anteriorly. In this lappet the ribs bordering each bundle are more strongly developed than the rest. The plications are separated by smooth intercostal depressions.

Dimensions.

Diameter of the shell		19·5 mm.
" " umbilicus		6·5 "
Height of the last volution	above the umbilical suture	7 "
	" " preceding whorl	6 "
Thickness of the last volution		5 "

In my specimen a little more than one-half of the last volution belongs to the body-chamber.

Sutures.—The sutural line of *Phormedites fasciatus* was unknown to E. v. Mojsisovics, to whom only a single specimen from the red marble of Hallstatt was available for examination. In my Indian specimen I have succeeded in developing the sutures of the last air-chamber. Thus the diagnosis of *Ph. fasciatus* may be completed by the following description:—

The sutures are very simple. Siphonal lobe almost as deep as the principal lateral lobe, but very narrow and divided by a short median prominence, each wing terminating in a single sharp point. Principal lateral lobe ceratitic, with a small number of indentations along its base. Second lateral lobe and saddle flatly arched and low. No distinct auxiliary lobe outside the umbilical suture.

2. PHORMEDITES sp. ind. aff. JUVAVICO Mojsisovics. Pl. XI, fig. 10.

From the Tropites-limestone of Tera Gádh (coll. Smith) there is a fragment of the body-chamber with part of the inner volutions of a species of *Phormedites*, which seems to be very nearly allied to *Ph. juvavicus* E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 427, Taf. CXLII, fig. 1) from the noric Hallstatt-limestone of the Sommeraukogel. This Alpine species comes in every respect nearest to the present form, with the only exception that the arrangement of the transverse ribs into fasciculi is more strongly developed in the former.

The whorls overlap each other to more than one-half their height. They increase slowly, and are less strongly compressed than in *Phorm. fasciatus*, but are higher than broad. Near the aperture the cross-section is of elliptical shape, neither the siphonal nor the umbilical margins being distinctly marked. But at the beginning of the last volution a blunt siphonal margin is faintly developed, and the umbilical margin is sharpened into an edge, which separates the flatly arched lateral parts from the low but perpendicular umbilical wall.

The lateral parts are very gently vaulted and nearly flat in the middle. The siphonal area is strongly curved and elevated into a median band, recalling the median elevation in some species of the sub-genus *Parathisbites*.

The sculpture consists of broad, falciform ribs, which are either simple or dichotomous. As a rule, two ribs of equal strength originate from one single spot at the umbilical edge, forming there occasionally indistinct umbilical tubercles. These ribs are grouped into broad plications, which are separated by still broader intercostal spaces. But both the arrangement of bundles of ribs into plications and the development of intercostal depressions is less clearly marked than in *Ph. juvavicus*. The inclusion of the present species in the sub-genus *Phormedites* is, however, justified by the ornamentation of the external area. This is crossed by the transverse ribs, which form semilunular lappets, with their convexity turned forward. Some of those lappets are bordered by deeper intercostal depressions than the rest, thus marking the borders of fasciculi or plications of the first order.

On the whole the type of *Phormedites* is much more clearly developed in this specimen than in *Buchites Emersoni*, a Himalayan species which exhibits close affinities to the subgenus *Phormedites*, but less so than in the two Alpine representatives of this subgenus.

Dimensions.

Diameter of the shell		26 mm.
" " " umbilicus		6·5 "
Height of the last volution	above the umbilical suture	11 "
	" " preceding whorl	7·5 "
Thickness of the last volution		7 "

Sutures.—Not known in detail.

Remarks.—There is no close relationship between this species and the two species of *Phormedites* from the Triassic limestones of Santo Stefano Quisquina in Sicily, which have been described and figured as *Ph. Schopeni* and *Ph. pygmaeus* by Gemmellaro.

Subgenus: *Buchites* Mojsisovics.

1. Buchites cf. hilaris Mojsisovics. Pl. XI, fig. 11.

1893. *Buchites hilaris* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst, VI—2, p. 415, Taf. CXXIII, fig. 1.

This species is represented by a single specimen, but the state of preservation of the inner volutions is not favourable for investigation. It belongs to the subgenus *Buchites*. In its general shape and involution it strongly resembles the subgenus *Danubites* Mojs. but differs from it by such characters as have been enumerated by E. v. Mojsisovics as leading features of *Buchites*, namely, the absence of a thread-like median line along the rounded siphonal part, the presence of dichotomous and intercalated ribs, which are slightly falciform, not straight as in *Danubites*.

My specimen is either very closely allied to or identical with *Buchites hilaris* Mojs. from the carnic Hallstatt-limestone of Aussee, but it is not possible to establish the identity of the Indian fossil with the European species with full certainty.

The slowly increasing volutions overlap each other to the extent of exactly one-half their height. They are of equal height and width. The broadly rounded siphonal area passes gradually into the flattened lateral parts. The number of volutions is not exactly known to me, but the umbilicus is scarcely as broad as in the type-specimen of *B. hilaris* illustrated by E. v. Mojsisovics.

So far as the inner whorls have been preserved, they exhibit a transverse sculpture, consisting of numerous simple, radial ribs. These ribs are distinctly falciform in the last volution, being strongly bent forward in the marginal region. They do not cross the siphonal area without interruption, but either terminate alternately along the median line or else unite, but in the latter case they diminish remarkably in strength. As in *B. hilaris* this weakening of the ornamentation is caused by a general elevation of the siphonal area, which chiefly affects the intercostal furrows. The elevation nearly reaches the general height of the ribs and consequently obliterates the intercostal valleys. This zone of obliteration of the transverse sculpture is accompanied on each side by a faint spiral line, which is distinctly indicated on the tops of the ribs, causing them to rise in faintly marked prominences.

The ribs are either simple or dichotomous. As a rule, the bifurcation originates in the umbilical margin. Intercalated ribs also occur, but rather rarely.

My personal examination of the type-specimen of *Buchites hilaris* has convinced me of its almost complete agreement with my Indian example, even in the minor details of its sculpture. This agreement is closer than one might be led to suppose from an inspection of the figures given by E. v. Mojsisovics. The only difference between the two shells consists in the slightly more involute character of the inner volutions of the Himálayan specimen. As the Alpine species is represented by a single specimen only, nothing is known about the range of variation to which the involution may be liable. I consequently prefer to abstain from a direct identification of the Indian and European forms.

Dimensions.

Diameter of the shell	14·5 mm.
" " " umbilicus	5·5 "
Height } of the last volution	5 "
Thickness } of the last volution	5 "

Sutures.—Not known in detail, but apparently very simple. One-half of the last volution belongs to the body-chamber.

Locality. Number of specimens examined.—Tropites beds of Kalapani (coll. A. v. Krafft). 1.

Remarks.—A species, which appears to be very closely allied to the present one, is *Buchites tyrrhenus* Gemmellaro (I cefalopodi del Trias superiore della regione occidentale della Sicilia, p. 25, pl. XVIII, fig. 21-24) from the grey Triassic limestone of Castronuovo and Santo Stefano Quisquina. As far as can be understood from a study of the figures and description, the Sicilian form seems to differ only by slightly more compressed and more slowly increasing whorls, and by the absence of any longitudinal nodular line running across the costæ along the siphonal part. It must, however, be remarked that the latter character, which has been noticed in *B. hilaris* by E. von Mojsisovics and in the Himálayan specimen by myself, is but very faintly developed.

2. BUCHITES EMERSONI nov. sp. Pl. V, fig. 8.

Although this is one of the more common species of the Tropites-limestone of Tera Gádh (coll. Smith), I am in some doubt with regard to its generic relations. All my specimens are casts devoid of their shelly substance. In some of them the characters of the subgenus *Buchites* are as clearly marked as in the preceding species. On the other hand, they appear also to be nearly allied to *Phormedites fasciatus* Mojsisovics (Abhandl. K. K. Geol. Reichsanst., VI-2, p. 428, Taf. CXLIV, fig. 6), especially so in the character of involution and in the development of ribs, which occasionally, though not regularly, show traces of an arrangement into fasciculi.

The figured specimen, which may be taken as type of the species, is the largest in the Himálayan collection and is provided with its entire body-chamber, to which nearly two-thirds of the last volution belong.

In its general shape it recalls *B. Aldrovandii* E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. etc., VI-2, p. 411, Taf. CXXIII, fig. 11). There is neither a siphonal nor an umbilical margin developed, but the flatly arched lateral parts pass gradually into the rounded siphonal area. The regularity of its curve is not interrupted by any elevated median band or thread-like depression. Its cross-section is elliptical, of almost equal height and width. The umbilicus is very broad. The involutions overlap each other on the siphonal part only. In the transverse sculpture two types of ribs predominate. Strong main ribs originate a short distance outside the umbilical suture, and run in a nearly straight line across the lateral parts. In the vicinity of the siphonal area they are turned forward and meet with the corresponding ribs from the opposite flank along the median line of the siphonal area, thus forming a semicircle with a diameter of 4 mm. The second group of ribs consists of intercalated costæ, which are smaller and occur to the number of one, two or three between two main ribs. Dichotomous ribs are rather rare, but occasionally two ribs may be seen originating from the same point near the umbilical suture. The ribs are not arranged quite symmetrically on either side of the shell.

This pattern of sculpture is the same as that exhibited by a number of typical species of the subgenus *Buchites*, which in their general shape, involution and sculpture recall the very closely allied subgenus *Danubites*, Mojs. (group of *Celtites Florianites* Mojs., *Florianites* Hyatt), but differ from it by their continuous sculpture, which is not interrupted along the median line of the siphonal area.

To this pattern of ornamentation, however, a second is added in the present species; which points to a close relationship with the subgenus *Phormedites* Mojs. distinguished by the development of plications which correspond to the fasciculi of ribs. In the present species some of the intercostal depressions are more deeply excavated than the rest. This feature is especially well marked along the borders of the semicircles, where the transverse ribs cross the siphonal area. Typical fasciculi of ribs, it is true, as in *Phormedites juvavicus* or in *Ph. fasciatus*, are not developed, but the ribs show a distinct tendency to group themselves into bundled plications. Nevertheless I think that this tendency is not sufficiently well marked to place our species among the representatives of *Phormedites*, and I consequently prefer to leave it with *Buchites*.

Dimensions.

Diameter of the shell	22 mm.
„ „ „ umbilicus	10 „
Height of the last volution { above the umbilical suture	6·5 „
„ „ preceding whorl	5·5 „
Thickness of the last volution	6 „

In the aperture of the figured specimen a portion of the mouth-margin has been preserved. The peristome does not correspond exactly with the transverse sculpture but is directed forward more strongly, thus cutting off the ribs obliquely.

Sutures.—The sutural line is similar to that of *Buchites Aldrovandii* Mojsisovics (l. c., p. 411, Taf. CXXXIII, fig. 11), but differs by the presence of a very deep siphonal lobe, which stands on an equal level with the principal lateral lobe. The siphonal lobe is moderately broad and divided by a low median prominence of trapezoidal shape. Its two wings exhibit two or three small denticulations, of which the one next to the median prominence is the deepest. The principal lateral lobe is broadly rounded and faintly serrated along its base. The second lateral lobe is very short and goniatitic. It is followed by a small flatly arched lateral saddle. There are no auxiliary elements present outside the umbilical suture.

Subgenus: *THISBITES* Mojsisovics.

Some difficulty has been experienced in assigning their proper systematic position to the Himálayan species united in this subgenus. Following E. v. Mojsisovics, I have included them in the subgenus *Thisbites*, notwithstanding their considerable dimensions and the ceratitic development of their sutures.

A full discussion of the systematic value of their distinctive features will be found in the following description of *Thisbites Meleagri*.

1. THISBITES MELEAGRI Mojsisovics. Pl. XI, figs. 17, 18.

1896. *Thisbites Meleagri* E. v. Mojsisovics, Beitraege zur Kenntniss der obertriadischen Cephalopodenfaunen des Himalaya, Denkschr. Kais. Akad. d. Wiss. Wien, Bd. LXIII, p. 620, Taf. XIV, fig. 10.

1899. *Thisbites Meleagri* E. v. Mojsisovics, Palæont. Indica, ser. XV. Himálayan Fossils, Vol. III, Pt. 1, p. 56, pl. XIV. fig. 10.

A small ammonite with strong, falciform, undivided ribs and a high external keel, from the Tropites-limestone of Tera Gádh, was described as *Thisbites Meleagri* by E. v. Mojsisovics in 1896. Among the materials collected by Smith and A. v. Krafft at Tera Gádh, Kalapani and Lilinthi this species is rather richly represented. It attains larger dimensions than any of the species of *Thisbites* hitherto known. The specific identity of the large individuals with the small specimen described by E. v. Mojsisovics has been made certain by developing their inner nuclei, which agree entirely with the prototype of the species. That the elongated shape of the shell in this prototype is only accidental and not a character of specific value, is shown by the fact that more or less elongated and elliptical individuals occur together with normally coiled examples.

Of the two specimens illustrated the one represented in fig. 18 is of normal shape and size. Fig. 17. represents a large-sized specimen, though not the largest in the Himálayan collection. Examples of dimensions intermediate between fig. 18 and the type illustrated by E. v. Mojsisovics are also very common, but, as a rule, consist of air-chambers only. The two figured examples are provided with their body-chambers.

Young individuals with their whorls as strongly compressed as in the type-specimen of E. v. Mojsisovics are rare. In the adolescent stage more globose shapes usually predominate, although the height of the transverse section always exceeds its width. The volutions of full-grown specimens are always strongly compressed.

In the two figured specimens the overlap of the last over the penultimate whorl amounts to three-fifths of the height of the former. The involution does not take place exactly at the umbilical margin. The umbilicus is, however, of only small size.

The whorls are lenticular with very flatly arched lateral parts. They converge gradually towards the steeply rounded siphonal part, which terminates in a sharp and high external keel. This keel is well individualised and, in later stages of growth, distinctly defined at its base, but not accompanied by excavated keel-furrows.

E. v. Mojsisovics describes the sculpture as follows :—" The lateral sculpture consists of strong, sickle-shaped ribs, which run out on the external part thin and thread-like to the next succeeding rib, touching this latter, so that a continuous spiral line is formed, in which the ribs meet. At the beginning of the last whorl the ribs are crowded. Later they are, however, wider apart, so that at the end of the last whorl wide intercostal areas occur. The ribs remain as a rule undivided. Only quite exceptionally bifurcations of the ribs occur near the umbilical margin."

This sculpture is subject to some variation, especially in full-grown specimens. Whereas in the inner volutions simple, undivided ribs prevail, the reverse is the case in the last whorl of larger individuals. A pair of ribs frequently originates from the same spot at the umbilical margin, but such spots are never marked by tubercles or prominences of the ribs. The ribs are always delicate and less strongly developed on the lower portion of the flanks. It is in the convexity of the segment that they describe on the upper portion of the lateral parts that they become broad and slightly elevated. They do not, however, extend into marginal tubercles. Some of the ribs are divided near the middle of their height, but the proportion of simple and bifurcated ribs differs widely in different specimens. It would be utterly impossible to base a specific distinction on this variable feature. Intercalated ribs also occur frequently, some of them reaching to the middle of the flanks and some affecting the marginal region only.

The thread-like spiral line, along which the ribs meet on the siphonal part, near the base of the external keel, is distinctly developed in the majority of my specimens. It is often interrupted for some distance, but rather irregularly, and is in some examples very delicate.

The high external keel is perfectly smooth. No trace of crenulation or of ribs crossing it has ever been noticed.

Dimensions.—The measurements of the larger of the two figured specimens are as follows :—

Diameter of the shell		42 mm
" " " umbilicus		4·5 "
Height of the last volution	above the umbilical suture	23·5 "
	" " preceding whorl	15 "
Thickness of the last volution		9 "

Sutures.—The sutural line of *Thisbites Meleagri* was not known to E. v. Mojsisovics, who based his determination on the external characters only. I have been able to trace it on a fair number of specimens of every size. It exhibits the normal ceratitic development of sutures, consisting of saddles with unbroken margins, rounded above, and deep lateral lobes with many small indentations.

The siphonal saddle is the highest. The siphonal and principal lateral lobe stand at the same level. The siphonal lobe is bipartite. There is only one sharp point on either side of the rudimentary median prominence. The second lateral saddle is followed by a small and rather shallow auxiliary lobe and saddle.

Remarks.—The propriety of placing this species in the subgenus *Thisbites* has been discussed by E. v. Mojsisovics, but it must be borne in mind that the only specimen known to him was a young individual, the sutures of which were not accessible for examination.

If we pass in review the genera of upper Triassic ammonites with high external keels, with strongly compressed whorls and with a sculpture consisting of falciform ribs, there are only four to which it is possible to refer the present species, namely, *Eutomoceras*, *Paratropites*, *Thisbites* and *Parathisbites*.

Against a generic relation to *Eutomoceras* Hyatt, the early beginning of the bifurcation of the ribs and their slight curvature has been advocated by E. v. Mojsisovics. These two characters appear, however, to be of little value, since the examination of my rich material has convinced me of the existence of types in which bifurcation of ribs sets in at a rather early stage of growth. As to the curvature of the ribs, it only needs a glance at the illustrations given by E. v. Mojsisovics on Plates CXXX and CXXXI to see that the difference in the ornamentation of *Thisbites Meleagri* and *Eutomoceras* is insignificant.

There are, however, other characters, which, in my opinion, forbid its being classed among the representatives of the genus *Eutomoceras*.

The sutures of *Eutomoceras* are never ceratitic, but markedly dolichophyllic. There are, indeed, no ammonites among the section of *Ammonea trachyostraca*, which in the complicated arrangement of their sutural elements surpass some representatives of this genus (*E. Theron*, *E. subaculum*). *Eutomoceras* is, moreover, distinguished by the presence of a long body-chamber. It is true that in none of my numerous specimens of *Thisbites Meleagri* has the apertural margin of the peristome been preserved, but on the other hand in none of them does the part of the body-chamber that has been preserved exceed the length of one-half of a volution. This fact tends to prove that the species under consideration does not belong to the section of *Trachyostraca macrodoma*, but to the *Ceratitoidea* with short body-chambers.

The same remark applies to a comparison of the present species with *Paratropites* (group of *Tropites aequabiles*). Notwithstanding its distant similarity, resulting from the presence of a high and individualised keel and of a falciform ribbing, *Paratropites* in its external features shows less resemblance to *Thisbites Meleagri* than *Eutomoceras*. It differs from it by the shape of its transverse section. This is either broadly lenticular or cordiform. A species with strongly compressed whorls is not known to me among the representatives of this subgenus, which, moreover, possesses dolichophyllic, not ceratitic, sutures.

The last group of forms, which remain to be compared, are *Thisbites* and *Parathisbites*.

With *Thisbites* our species agrees in the majority of important characters. There are, however, two exceptions. All the species described by E. v. Mojsisovics from the carnic beds of the Hallsttat-limestone, are dwarf species, none of them exceeding 24mm. in diameter. Compared with those forms some of my Himalayan examples are true giants, but their large dimensions certainly constitute no valid argument against their relegation to *Thisbites* in view of the close agreement of the remaining characters. The second exception is the development of the sutural line, which is ceratitic, whereas E. v. Mojsisovics in his diagnosis of *Thisbites* states the lobes to be clydonitic, *i.e.*, free from indentations. This diagnosis loses, however, much of its importance, if we consider that among sixteen Alpine species of *Thisbites* there is only a single one (*Th. Agricolæ*) whose sutures have been examined in detail. I am consequently not inclined to overestimate the value of this statement.

In *Parathisbites* ceratitic sutures have been noticed. But the most remarkable character in this subgenus, which is so closely allied to *Thisbites*—in fact, its only feature of subgeneric value—is the development of lappets crossing the external keel and forming a direct continuation of the lateral sculpture. Now, my specimens are absolutely devoid of this sort of sculpture, and can consequently not be classed among the representatives of *Parathisbites*.

Thisbites Haushoferi Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI—2, p. 440, Taf. CXLII, fig. 26), *Th. Anatolis* Mojs. (*ibid.* p. 440, Taf. CXLII. fig. 25) and *Th. Borni* Mojs. (*ibid.* p. 429, Taf. CXLII, figs. 27, 28) have been mentioned by E. v. Mojsisovics among the congeneric species most nearly allied to the present one. Apart from the difference in their dimensions, *Th. Meleagri* and *Th. Anatolis* seem to approach each other most closely, but the difference in the width of the umbilicus will always make a distinction easy, even if one has to deal with young individuals.

Among all the Alpine species of *Thisbites* there is none with an umbilicus so small as that of *Th. Meleagri*.

2. THISBITES RONALDSHAYI nov. sp. Pl. XI, figs. 19, 20.

From *Thisbites Meleagri* the present species must be separated on account of its very delicate ornamentation, consisting of numerous falciform ribs.

In the umbilical region the ribs are faintly developed and narrow. They become slightly elevated in the upper portion of the lateral parts and are separated by low intercostal depressions, which are somewhat wider than the ribs. Their number is augmented either by intercalation or by bifurcation of the primary ribs. The bifurcation sets in most frequently in the middle of the height of the flanks. In the inner volutions most of the ribs rise in pairs from the umbilical margin. In the body-chamber of my full-grown specimen the sculpture is subject to some variation. Two or three of the sickle-shaped marginal ribs are united into a broad fold, which reaches across the lower portion of the flanks down to the umbilical margin. These broad folds are separated by equally wide and low intercostal spaces.

In its general shape this species is distinguished by very strongly compressed whorls. The umbilicus is wider than in the preceding species and distinctly opens out in the last whorl.

The distinction of full grown specimens of *Th. Meleagri* and *Th. Ronaldshayi* is easy, as will be seen from a comparison of their respective illustrations. But among the young examples of the two species transitional forms seem to exist, the range of variation in the sculpture of *Th. Meleagri* being rather considerable.

Dimensions.

		Fig. 19.	Fig. 20.
Diameter of the shell		33 mm.	26 mm.
" " " umbilicus		6 "	3 "
Height of the last volution	from the umbilical suture	18 "	18 "
	" " preceding whorl	14 "	10 "
Thickness of the last volution		7 "	7 "

Sutures.—The sutures are perfectly identical with those of the preceding species.

Remarks.—*Thisbites Ronaldshayi* is closely allied to *Th. Borni* Mojs. (Ceph. Hallst. Kalke, Abhandl. K. K. Geol. Reichsanst., VI—2, p. 427, Taf. CXLII, fig. 27, 28). Differences exist in the smaller umbilicus of the Indian shell and in the absence of the transitory paulostomes or lunulæ noticed in the Alpine species by E. v. Mojsisovics.

Th. Ronaldshayi has been collected in the Tropites-limestone of Lilinthi and Tera Gádh by Smith and A. v. Krafft, but is less numerously represented in the Himálayan collection than *Th. Meleagri.*

3. THISBITES CAMPBELLI nov. sp. Pl. XI, figs. 12, 13.

This is a genuine dwarf species like all the Alpine representatives of the subgenus *Thisbites.* Among my materials from Tera Gádh (coll. Smith and A. v. Krafft) there are only small individuals, but all are provided with parts of the body-chamber.

The most remarkable characters of this species are its globose shape and its very simple sculpture. The whorls are strongly inflated, being of nearly equal height and thickness. The greatest transverse diameter coincides with the upper limit of the lower third of the entire height of the whorls. From this point the lateral parts are bent in a regular curve towards both the umbilical margin and the siphonal part. The latter is provided with a high keel with its base marked off distinctly by faintly developed keel-furrows. The umbilicus is very small.

The simple lateral sculpture consists of straight transverse ribs, which are slightly turned forward in the marginal region. A thin, thread-like conjugation of the ribs along the external keel-furrow has not been noticed. The lower portion of the flanks is smooth. The ribs do not extend into the umbilical region. They are undivided.

Dimensions.

Diameter of the shell		21 mm.
" " " umbilicus		2 "
Height of the last volution	above the umbilical suture	12 "
	" " preceding volution	9 "
Thickness of the last volution		12 "

Sutures.—Very similar to those of *Thisbites Meleagri* and *Th. Ronaldshayi.* Principal lateral lobe deeper than the siphonal lobe. The auxiliary lobe is divided by the umbilical margin.

4. THISBITES (?) nov. sp. ind.

For the sake of completeness mention must be made here of two large, strongly compressed fragments of body-chambers from the Tropites-limestone of Kuti (coll. Krafft), which in general shape and sculpture agree with ***Thisbites Meleagri.*** In both fragments the last volution exceeds 30 mm. in height. Apart from their large size they are distinguished from *Th. Meleagri* by the egression of the umbilicus, which, as far as can be made out from such poorly preserved fragments, seems to be very considerable.

The advisability of placing this species in the subgenus *Thisbites* is questionable. I do not wish to overlook the possibility that we may, perhaps, be dealing with a new subgenus of *Ceratites.*

Subgenus: *PARATHISBITES* Mojsisovics.

According to the diagnosis given by E. von Mojsisovics, I have united in this subgenus only those species of *Ceratitidae,* which are distinguished by the development of external lappets crossing the siphonal keel.

In the Alpine Trias the subgenus *Parathisbites* is represented by two species, which are restricted to beds of noric age. In the Himalayan collections four species can be distinguished.

1. PARATHISBITES cf. SCAPHITIFORMIS Hauer. Pl. XI, figs. 22, 23.

1855. *Ammonites scaphitiformis* F. v. Hauer, Beitraege zur Kenntniss der Cephalopodenfauna der Hallstätter Schichten, Denkschr. Kais. Akad. d. Wiss math. nat. cl. Bd. IX, p. 179, Taf. II, figs. 4-6.

1879 *Hungarites scaphitiformis* E. v. Mojsisovics, Vorlaeufige Uebersicht der Ammonitengattungen der mediterranen und juvavischen Trias, Verhandl. K. K. Geol. Reichsanst., p. 170.

1893. *Parathisbites scaphitiformis* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI—2, p. 173, Taf. CXXXIX, figs. 11, 12.

Two specimens from the Tropites-limestone of Tera Gádh (coll. Smith) agree with ***Parathisbites scaphitiformis*** from the noric Hallstatt-limestone of the Sommeraukogel in such a remarkable manner that I should not have hesitated to identify them with it but for their smaller dimensions, and for some differences in details of the sutural line. F. v. Hauer's type-specimen is a moderately large shell of 55 mm. in diameter, whereas my examples although attaining only half this size, are nevertheless provided with body-chambers and have all the characters of the Hallstatt type fully developed, especially the egression of the umbilicus, by which the designation of ***scaphitiformis*** is justified. I consequently deemed it best to refer to the Indian form as ***P. cf. scaphitiformis*** and to leave the question of direct identity in suspense.

The high-mouthed volutions overlap one another considerably. The transverse section is lenticular and higher than broad. The umbilicus is very small in the adolescent stage of growth. With the beginning of the body-chamber, however, the umbilical suture slightly deviates from the normal spiral and the umbilicus gradually opens. In the meantime it becomes flatter. But this egression is not very strongly developed, considerably less for instance than in *Parajuvavites* or in some species of *Halorites*.

The external keel is broad and high, and distinctly individualised at its base. Its strong development is a very conspicuous feature in the European as well as in the Indian representatives of the species.

The sculpture consists of falciform ribs which are turned anteriorly in the marginal region. They rise in pairs or in fasciculi near the umbilical margin. Here some of them appear to be slightly elevated above the general level of the shell by the deepening of the intercostal depressions.

In the body-chamber a variation of the sculpture is noticed, the ribs being united into broad plications which are separated by wide intercostal valleys. This is the same pattern of ornamentation as is met with in F. v. Hauer's type-specimen of *Parathisbites scaphitiformis*. In my specimen illustrated in fig. 28 this individualisation of the single fasciculi is less distinctly marked, but the specimen very clearly exhibits the presence of spoon-shaped lappets on the external keel. Those lappets are formed by lateral plications uniting on either side of the median keel. In my second example this development of external lappets, the distinctive feature of the subgenus *Parathisbites*, is less clearly marked. In this respect it agrees exactly with F. v. Hauer's type-specimen from the Hallstatt-limestone.

Dimensions.

Diameter of the shell		27 mm
" " " umbilicus		5·5 "
Height of the last volution	above the umbilical suture	13 "
	" " preceding whorl	9·5 "
Thickness of the last volution		7·5 "

Sutures.—A comparison of the illustrations on Pl. XI of this memoir and of fig. 12 in the monograph of E. v. Mojsisovics will give the impression of considerable differences existing between the sutural lines of the Indian and European specimens. This, however, is not the case. The sutures of the two examples, by which the Alpine species is represented in the collections of the K. K. Geologische Reichsanstalt, in Vienna, have suffered greatly by grinding off a thicker portion of the shell than should have been done. With kind permission of the Director of the Geol. Reichsanstalt I have tried to lay bare the sutures at a place not formerly touched by the grinding stone or by hydrochloric acid, and I have succeeded in developing a fairly well preserved sutural line, an illustration of which is given on Pl. XI, fig. 27. From this figure it will be seen that the bifid siphonal lobe is not the deepest but a little shorter than the principal lateral lobe. It is, however, still deeper than in my Himálayan specimens, although the difference is almost insignificant. The margins of the saddles of the Indian examples appear entire to the naked eye, but by means of a magnifying glass delicate indentations are noticed. That they are less distinctly serrated than the marginal walls of the type-specimen from Hallstatt, is easily explained by their smaller dimensions.

There are two small auxiliary lobes present outside the umbilical suture.

The only detail in which the sutures of the Indian and Alpine specimens really differ is the length of the siphonal lobe, though this difference is of smaller importance than might be supposed from the description and figures of E. v. Mojsisovics.

2. PARATHISBITES cf. HYRTLI Mojsisovics. Pl. XI, fig. 16.

1893. *Parathisbites Hyrtli* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke. Abhandl. K. K. Geol. Reichsanst., VI-2, p. 445, Taf. CXXXIX, fig. 13.

Two specimens from the Tropites-limestone of Tera Gádh (coll. Krafft) agree so closely with *Parathisbites Hyrtli* Mojs. from the noric Hallstatt-limestone of the Sommeraukogel that it is only a matter of individual taste whether a direct identification or a provisional reference to that species as "*cf.*" should be preferred.

The figured specimen is of a slightly oblique shape and a little larger than the Hallstatt type. It is somewhat more strongly compressed, the proportion of height to width in the transverse section agreeing with that in *P. scaphitiformis.* The differences from that species are those which have been enumerated by E. v. Mojsisovics, namely the larger diameter of the umbilicus within the inner volutions and the small importance of the low external keel.

In the sculpture the grouping of ribs into bundles is faintly indicated. To the bundles there are corresponding plications which form transversely elongated prominences along the umbilical margin. The siphonal keel is crossed by the lateral ribs, which on the external area describe curves strongly turned forward. In general the ornamentation is a little more delicate in the Himálayan examples than on the Alpine type-specimen: but this may, perhaps: be due merely to the state of preservation.

Dimensions.

Diameter of the shell		23 mm.
„ „ „ umbilicus		5 „
Height	of the last volution	10 „
Thickness		6 „

Sutures.—Very similar to those of the preceding species, but the bifid siphonal and the principal lateral lobe stand at the same level and only one auxiliary lobe has been noticed outside the umbilical suture, which divides the small auxiliary saddle.

3. PARATHISBITES WINDHAMI nov. sp. Pl. XI, figs. 14, 15.

Among Smith's collections from the Tropites-limestone of Tera Gádh a new species of *Parathisbites* is very closely allied to *P. Hyrtli* Mojs., but differs from it in having genuine umbilical tubercles.

The arrangement of ribs into fasciculi is very distinctly developed, even in early stages of growth. As a rule, three ribs originating from a radially protracted umbilical prominence are grouped into a bundle. Each bundle corresponds to a low plication, which is separated from the adjoining plication by a broad inter-costal valley, which in width considerably exceeds the furrows between the single elements of fasciculi.

Simple intercalated ribs also occur, but only as an exception. In general the ornamentation of this species is distinguished by its remarkable regularity.

The shape of the siphonal part is exactly the same as in *P. Hyrtli.* The median keel is broad but very low and flatly arched. The presence of forward turned spoon-shaped lappets on the siphonal area is clearly marked. They form continuations of the ribs, not transitional peristomes or paulostomes. Traces of lunulæ have not been noticed. In the marginal region the sickle-shaped terminations of the ribs are connected by a thread-like spiral line, recalling the external spiral lines in *Thisbites Meleagri* Mojs.

Dimensions.

Diameter of the shell	24	mm.
„ „ „ umbilicus	5	„
Height of the last volution { above the umbilical suture	11	„
Height of the last volution { „ „ preceding whorl	8	„
Thickness of the last volution	8	„

Sutures.—In their arrangement and in the ceratitic development of the lobes very similar to the sutural line of the preceding species. The siphonal lobe is shorter than the principal lateral lobe and divided by a broad median prominence. In each of its wings an accessory denticulation is noticed besides the sharp terminal point. Second lateral saddle well individualised. One single auxiliary lobe outside the umbilical suture.

Remarks.—In its ornamentation the present species exhibits a great resemblance to *Thisbites Ronaldshayi* Diener. From this form it is, however, easily distinguished by its coarser ribbing, larger umbilicus, less strongly compressed whorls and low, flatly vaulted external keel.

4. PARATHISBITES NODIGER nov. sp. Pl. XI, fig. 21.

This species, represented by a single but well preserved specimen collected by Krafft from the Tropites-limestone of Kalapani is easily distinguished from other congeneric forms by the development of strong umbilical and marginal tubercles. In this respect it imitates the group of *Thisbites Burtini* Mojs., but, on account of the sculpture of its siphonal part, it cannot be separated from the subgenus *Parathisbites.*

The volutions are of nearly equal height and thickness. The lateral parts are flat and converge very little from the umbilical towards the siphonal margin. The siphonal area is marked off from the flanks by a blunt edge. It is broad and flatly curved. A low and broadly rounded keel is restricted to the median part of the siphonal area and is not more strongly developed than in *P. Hyrtli* Mojs. The slowly increasing volutions enclose a comparatively wide umbilicus. The greater part of the inner whorl is exposed within the umbilical area. The maximum thickness of the volutions coincides with the rounded umbilical margin, from which the lateral parts of the shell slope in a regular curve down to the umbilical suture.

One-quarter of the last volution belongs to the body-chamber.

The sculpture of this little shell is very prominent. On the exposed flanks of the inner volutions strong umbilical tubercles are noticed, recalling in their strong development the sculpture in young individuals of *Keyserlingites* Hyatt (*Robustites* Philippi, group of *Ceratites subrobusti*). Near the beginning of the last whorl the umbilical tubercles disappear and for some distance the ornamentation consists of numerous and delicate falciform ribs only, which are slightly elevated in the vicinity of the siphonal margin. A short distance from the last air-chamber very coarse umbilical tubercles make their appearance again. In the meantime the marginal elevations of the ribs also develop into proper tubercles. Thus in the vicinity of the aperture two rows of tubercles or spines are formed, one along the umbilical and the other along the siphonal margin. In this region of the shell the falciform ribs become rather irregular. Some of them bifurcate in the umbilical tubercles, some remain undivided. Occasionally even a conjugation of two ribs is noticed, which, bifurcating in an umbilical tubercle, are united again in the marginal spiral.

The ornamentation of the siphonal area is faintly marked, It is, however, distinctly developed in the vicinity of the aperture, where the broad, anteriorly turned lappets are seen to cross the external keels. Their correspondence with the lateral ribs is sufficiently obvious to justify the present species being placed in the subgenus *Parathisbites*.

Dimensions.

Diameter of the shell		18 mm.
„ „ „ umbilicus		5 „
Height of the last volution	above the umbilical suture	8 „
	„ „ preceding whorl	6 „
Thickness of the last volution		7·5 „

Sutures.—Very similar to those of *P. Hyrtli*; siphonal lobe bifid, with a broad but low median prominence, a little shorter than the strongly serrated principal lateral lobe. Siphonal saddle higher than the principal lateral saddle. Second lateral lobe and saddle very low. One auxiliary lobe outside the umbilical suture.

Remarks.—There exists a striking resemblance between this species and a representative of the group of *Ceratites geminati* in the Muschelkalk of the Arctic region, *Ceratites laqueatus* Lindstroem (Memoirs of the Swedish Academy of Sciences, Vol. VI, p. 5, Pl. II, figs. 3, 4) from the Daonella-limestone of Spitzbergen. The illustration of Lindstroem's type-specimen by E. v. Mojsisovics (Arktische Triasfaunen, Mémoires Académie Impér. des sciences de St. Petersbourg, 7 ser. 1886, T. XXXIII, No. 6, p. 51, Taf. IX, fig. 2) shows an ammonite, which, although surpassing *Parathisbites nodiger* enormously in its dimensions, still exhibits a close agreement in its general shape and sculpture. Falciform ribs adorned with marginal tubercles are the predominating element of sculpture; to these a few stout umbilical tubercles are added on the body-chamber. The ribs cross the flatly curved siphonal area and its low median keel in the shape of anteriorly turned lappets exactly as in typical species of the subgenus *Parathisbites*.

Attention has been drawn to the close relationship of the upper Triassic *Thisbites* to the Arctic group of *Ceratites geminati* by E. von Mojsisovics, but some species of the latter group, especially *C. laqueatus*, appear to be still more nearly allied to *Parathisbites*. On this species the lappets crossing the siphonal area do certainly correspond to a continuation of the lateral ribs as in *Parathisbites*, not to transitional peristomes or paulostomes as in *Ceratites geminatus* or in *C. Nathorsti*. The question may be raised, indeed, whether *C. laqueatus* should not be removed from the group of *C. geminati* and considered as the ancestor of the noric subgenus *Parathisbites*.

Genus: JELLINEKITES nov. gen.

This new genus is introduced for the accommodation of three species from the Tropites-limestone of Lilinthi, which have such a peculiar combination of characters that they cannot be incorporated with other genera.

The widely umbilicated shells with slowly increasing whorls recall in their general shape and involution the genus *Arpadites* Mojsisovics, but the sculpture of the siphonal and marginal regions is entirely different. The median line of the siphonal area is marked by a high and sharp keel, which is accompanied by deep, rounded keel-furrows on either side. Each of these two siphonal keel-furrows is bordered along the siphonal margin by another keel, corresponding with the median keel in height and sharpness. But these marginal keels are of a very peculiar kind. They are formed by a conjugation of the lateral ribs, each rib running out on the external part to the next succeeding rib and touching it, so that a spiral keel is formed, in which the ribs meet.

Neither the marginal nor the median keels are continuous, but are occasionally interrupted by depressions, which in their direction correspond with the lateral sculpture. Most of the intercostal valleys die out in gradually narrowing, sickle-shaped depressions between the marginal keel and two succeeding ribs. But occasionally an intercostal valley crosses the siphonal area in a curve strongly bent towards the anterior part, interrupting marginal and siphonal keels. Thus contractions of the shell are formed which may be compared to the paulostome-furrows of *Anatomites* Mojsisovics.

As characters of generic importance, the combination of paulostome-furrows or contractions with lateral ribs and tubercles, and the presence of three distinct keels may be quoted, the two marginal keels resulting from a conjugation of lateral ribs along the siphonal margin.

For this new genus the denomination of *Jellinekites* is proposed, in honour of S. Jellinek, whose works on the physiological effects of electricity are well known in science.

Jellinekites is so far only known from the Tropites-limestone of the Himálayas, where it is represented by three species.

I am in some doubt with regard to the systematic position of this isolated genus. That it belongs to the section of *Trachyostraca brevidoma*, not to the *Tropitoidea*, is pretty certain. In my type-specimen of *Jellinekites Hoveyi* (Pl. XI, fig. 8) the aperture seems almost to coincide with the actual peristome of the shell. The length of the body-chamber therefore scarcely amounts to more than one-half of the last whorl. Nor has any been met with among my fifteen specimens in which more than one-half of a volution belongs to the body-chamber.

The sutural line shows the normal number of ceratitic lobes. Thus the place of *Jellinekites* among the *Ceratitidæ* is ascertained.

The presence of a high external keel excludes any relationship with the sections of *Distichitea*, *Trachyceratea*, *Orthopleuritea* or *Heraclitea*. There is some probability in favour of the correctness of assigning to this isolated genus a systematic position under *Ceratites*, especially near the subgenera *Thisbites* and *Parathisbites*. In *Thisbites* transitory peristomes, a feature very nearly allied to paulostome-furrows, often occur. In *Thisbites Meleagri* Mojs. the presence of a continuous spiral line along the base of the external keel on either side has been noticed by E. v. Mojsisovics. This spiral line is formed by the strong sickle-shaped ribs, running out on the siphonal part thin and thread-like to the next succeeding rib, touching this latter. If we imagine an ammonite, in which this thread-like spiral line resulting from the conjugation of two or more lateral ribs were elevated into a proper keel, and if we imagine the spoon-shaped lappets, which in *Parathisbites* cross the siphonal part, to be bordered by deeply excavated constrictions, a shell resembling *Jellinekites* will be formed by the combination of these two peculiar characters.

1. Jellinekites Barnardi nov. sp. Pl. XI, fig. 6.

This species is to be considered as prototype of the genus. It is the largest, and provided with a very coarse sculpture, and has the distinctive features of generic importance most clearly developed.

The slowly increasing whorls overlap one another very little. The inner volutions are consequently exposed within the large open umbilicus. The lateral parts are flat. The greatest transverse diameter coincides with the rounded-off umbilical margin. From the line of their greatest thickness the whorls bend down to the umbilical suture in a regular curve without the interposition of a distinct umbilical wall. From the siphonal part the flanks are separated sharply by the high marginal keels, which border the deeply excavated, rounded keel-furrows. The median keel rises somewhat above the level of the two marginal keels.

On the inner volutions the sculpture consists of strong umbilical and lateral spines or tubercles, connected by straight, radial ribs. Although the lateral spines are situated not far from the marginal keel, they are entirely exposed within the umbilicus, the umbilical suture remaining outside the spiral row of lateral tubercles of the preceding volution.

On the last volution the sculpture becomes more irregular. The umbilical tubercles persist, but the lateral tubercles are not developed on every rib, and are of unequal strength. The ribs are coarse and broad, and separated by wide intercostal spaces. They are either simple or originate in pairs from the umbilical spines. If they occur in pairs, the anterior rib is always the weaker one. The elevation of the lateral tubercles, or the spot where they ought to be, is marked by a general swelling of the ribs in width and by a more or less sharp geniculation. From this geniculation the ribs are strongly turned forward towards the aperture, running for some distance almost parallel to the marginal keel before meeting it.

At three places contractions are noticed, resulting from a complete interruption of lateral sculpture and keels. One of the wide intercostal spaces thins out gradually between the marginal portions of two ribs, and at last crosses the marginal keel in a narrow breach. A corresponding lower depression in the median keel marks the most anterior point of the contraction. By carefully examining one of these contractions, it is clearly seen that the marginal keels are not independent of the lateral ribs but are exclusively formed by their conjugation. On the anterior side of the contraction the succeeding rib is itself developed into the marginal keel.

The contractions occur at irregular distances. Between the two anterior ones of my type-specimen a marginal keel is intercalated, resulting from the conjugation of three ribs only.

Dimensions.

Diameter of the shell	36	mm.
,, ,, ,, umbilicus	12·5	,,
Height of the last volution { above the umbilical suture	15	,,
,, ,, preceding whorl	13	,,
Thickness of the last volution	10	,,
,, ,, ,, ,, measured along the distance of two umbilical spines	12	,,

Sutures.—Not known in detail.

Locality.—Number of specimens examined.—Lilinthi, 2 (coll. Krafft).

2. JELLINEKITES SAUNDERSI nov. sp. Pl. XI, fig. 7.

This species is distinguished from *Jellinekites Barnardi* by its less complicated sculpture. Umbilical tubercles are completely absent and marginal tubercles are faintly developed and chiefly restricted to the inner volutions. The term "marginal" has been assigned to these tubercles, because the two keels bordering the keel-furrows do not form a demarcation of the siphonal and lateral parts but are situated externally. The siphonal margins correspond to the line which in the preceding species is marked by the spiral row of lateral tubercles. The siphonal area is consequently much broader in proportion to the height of the volutions than in *J. Barnardi*.

The transverse section is approximately rectangular and the distance from the umbilical and siphonal margins, respectively, nearly equal in length. The whorls embrace one another only on the broad siphonal part.

My specimens consisting of air-chambers only, the sculpture of the body-chamber is not known to me. This makes the diagnosis of the species to a certain extent incomplete. In the last volution of my examples the sculpture is subject to small variation only. The marginal spines, which are noticed as a permanent character on the inner volutions, are gradually obliterated, and many ribs remain free from this kind of ornamentation. The ribs are delicate, mostly simple, but rarely bifurcating at the umbilical margin, and separated by very broad intercostal spaces of irregular width. In general the sculpture is much more delicate than in the preceding species, especially so along the siphonal area.

Neither the median nor the two other external keels—they are not marginal in the present species—rise to the same height as in equally-sized specimens of *J. Barnardi*. Contractions, accompanied by interruptions of the external sculpture, occur more frequently. In the anterior half of its last volution my type-specimen exhibits five contractions or paulostome furrows. They are very narrow, only one-third part of the width of the corresponding intercostal spaces, but nevertheless they interrupt the keels completely.

The ribs are sharp and inversely imbricating, their steeper slope being turned backwards.

Dimensions.

Diameter of the shell		22 mm.
„ „ „ umbilicus		8·5 „
Height	of the last volution	9·5 „
Thickness	of the last volution	8 „

All my specimens consisting of air-chambers only, the dimensions attained by full-grown individuals were probably little inferior to those of the preceding species.

Sutures.—The species has the normal number of lobes. The projection of the periphery of the penultimate whorl touches the umbilical saddle in the last volution. Thus the lobe following the principal lateral saddle must be designated as second lateral lobe, notwithstanding its position in the vicinity of the umbilical suture.

Siphonal lobe bifid and divided by a very low median prominence with rounded top. Lateral lobes ceratitic, serrated at their base. Saddles entire. Siphonal and principal lateral lobes equally deep. Siphonal saddle slightly surpassing the principal lateral saddle in height. The umbilical saddle is the second lateral saddle. No auxiliary lobes.

Locality.—Number of specimens examined.—Lilinthi 3 (coll. Krafft).

3. Jellinekites Hoveyi nov. sp. Pl. XI, fig. 8.

The Himálayan collection contains a rich assemblage of this species, which differs from *Jellinekites Barnardi* and *J. Saundersi* principally by its more slowly increasing, compressed whorls and numerous falciform ribs.

The species possesses a flat, discoidal shell, very similar in its outlines to that of ***Arpadites* Tassilo** Mojs. or of ***A. Orion*** Mojs. from the carnic stage of the Hallstatt-limestone. The volutions overlap one another but very little.

The lateral parts are flatly arched. The siphonal area is considerably narrower than in *J. Saundersi*, the margins corresponding exactly to the keels, which are formed by the conjugation of lateral ribs. The marginal and median keels are of equal height, and more strongly developed than in the preceding species. The umbilicus is wide but low. No distinct umbilical wall is marked off from the steeply curved slope of the lateral parts to the umbilical suture.

In the development of its sculpture the present species holds an intermediate position between *J. Barnardi* and *J. Saundersi*. Tubercles are but faintly indicated and only along the umbilical margin of the body-chamber. Lateral spines are entirely absent.

The ribs are very numerous and of falciform shape. They originate as single ribs or in pairs near the umbilical margin. Intercalated ribs, which do not reach down into the lower portion of the flanks, also occur, but rarely. Paulostome furrows interrupting the sculpture occur more frequently than in the two preceding species. In my type-specimen not less than nine contractions are noticed in the last half volution. Near the aperture they actually become so crowded, that only two or three ribs are united in a marginal keel between two succeeding paulostome furrows.

The falciform character of the ribs is marked in the last volution only. On the inner volutions the transverse ribs are straight and run in radial directions.

Dimensions.

Diameter of the shell	27	mm.
" " " umbilicus	11	"
Height } of the last volution	9	"
Thickness } of the last volution	6·5	"

Sutures.—Almost identical with those in *J. Saundersi*.

Locality.—Number of specimens examined.—Lilinthi 10 (coll. Smith and A. V. Krafft).

Genus : ARPADITES Mojsisovics.

ARPADITES TASSILO Mojsisovics. Pl. VII, fig. 6.

1893. *Arpadites Tassilo* E. v. Mojsisovics, Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol Reichsanst., VI-2, p. 454, Taf. CLIII, fig. 2.

This species of the carnic Hallstatt-limestone of the Alpine Trias is represented in Smith's collection from Tera Gádh by a single but excellently preserved specimen which permits of accurate determination.

In general shape, involution, size and sculpture my Himálayan example agrees perfectly with the type-specimen of *A. Tassilo* from the Ellipticus beds of the Feuerkogel near Aussee. It consists of slowly increasing volutions overlapping one another by less than one-half of their height, and leaving open a wide umbilicus. The cross-section is nearly rectangular and considerably higher than broad.

The difference between those two dimensions is even greater than in the Alpine type-specimen. The lateral parts are flat, hardly at all curved and separated from the umbilical suture by a very low wall. The umbilical margin is not marked off sharply, but regularly rounded. From the siphonal area the flanks are separated by a blunt marginal edge. The siphonal area itself is flat and provided with two external keels, enclosing a low median furrow. Both of them are accompanied by faintly-marked external furrows, which are considerably less strongly developed than the median furrow.

The innermost volutions are smooth, as far at least as they are not embraced by the following whorls. The two last volutions exhibit the delicate but rich ornamentation, which is a remarkable feature of this beautiful species. It consists of very numerous thin and rounded falciform ribs. Simple ribs alternate irregularly with intercalated and dichotomous folds. Bifurcation sets in, as a rule, in the vicinity of the umbilical margin, but rather rarely in the upper portion of the lateral parts. A pair of equally strong ribs, rising in a small umbilical tubercle, forms the principal element of this lateral sculpture.

Umbilical tubercles are faintly developed along the umbilical margin of the last volution. It is only in the vicinity of the aperture that they gradually disappear.

The ribs cross the siphonal margin in a curve strongly bent forward and are raised into small, elongated tubercles on the crest of the external keels. They unite in the median depression between the two keels, thus describing a strongly elongated lappet with its convexity turned anteriorly in crossing the siphonal area.

One-half of the last volution belongs to the body-chamber. The obliteration of the umbilical tubercles and the weakening of the strength of ribs, which are more densely crowded in the vicinity of the aperture, make me suppose that the last rib may, perhaps, correspond to a true mouth-margin.

Dimensions.

Diameter of the shell	22 mm
„ „ „ umbilicus	7 „
Height of the last volution { above the umbilical suture	9 „
„ „ preceding whorl	7·5 „
Thickness of the last volution	6 „

Sutures.—The sutures of the Alpine type-specimen of *Arpadites Tassilo* were not known to E. v. Mojsisovics. My Himálayan specimen exhibits its sutural line with all its details. It agrees with the sutures of the Alpine representatives of the genus *Arpadites* of the ladinic stage. The sutures are very simple, with faintly serrated lobes and entire saddles, recalling *A. Cinensis* Mojsisovics (Cephalopoden der Mediterranen Triasprovinz, Abhandl. K. K. Geol. Reichsanst., X, p. 56, Taf. XXVI, fig. 7).

The siphonal lobe is divided by a very low median prominence. Each wing is provided with a small number of insignificant denticulations, which can only be seen by means of a magnifying glass. The principal lateral and siphonal saddles are of nearly equal height. There is no auxiliary lobe present, but only a very small saddle between the second lateral lobe and the umbilical suture. As the projection of the periphery of the penultimate whorl touches the principal lateral saddle along its inner margin in the last volution, it is merely a matter of convenience whether the second lobe and saddle be considered as auxiliary or as lateral elements.

Subgenus: *Dittmarites* Mojsisovics.

1. Dittmarites Rawlinsoni nov. sp. Pl. VII, fig. 4.

The figured specimen from the Tropites-limestone of Tera Gádh (coll. Smith), which may stand as the prototype of the species, shows a great resemblance in shape and sculpture to *D. Dorceus* v. Dittmar. For a complete description of this species from the carnic stage of the Hallstatt-limestone the memoir of E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 460, Taf. CLIII, figs. 11, 12) should be consulted.

The slowly increasing whorls envelop each other to one-third of their height and leave a wide, stair-like umbilicus open. They are high, compressed, and elliptically rectangular in section. The lateral parts are very gently curved and, in the marginal region, bend gradually towards the regularly rounded siphonal area. There is no distinct, sharply rounded marginal edge, as in *D. Dorceus*. On the other hand the umbilical margin is very sharply marked. A blunt edge separates the lateral parts from the high and perpendicular umbilical wall. It is this high, spiral wall which imparts to the inner whorls within the umbilicus a stair-like appearance.

The median line of the siphonal area coincides with a low depression, which is accompanied by external keels, which are followed by keel-furrows equal to the median depression in width and depth. The two keels are not high enough to rise above the general convexity of the central area. In dimensions they are inferior to the high and strong keels of *D. Dorceus*, but this difference is, perhaps, explained by the fact that my Himálayan specimen is a cast devoid of its shelly substance, whereas Dittmar's type-specimen from Aussee was provided with its shell.

The ventral area is entirely smooth and devoid of any ornamentation, which is confined to the lateral parts and to the umbilical wall.

The pattern of ornamentation is nearly the same as in *D. Dorceus*. In the inner volutions the ribs are broad, with rounded tops, and separated by intercostal spaces of equal width. In the last volution the number of ribs increases considerably. The ribs are narrower and sharp, and the intercostal valleys nearly twice as broad. The greater number of sharp and narrow ribs is the chief feature of difference between the Himálayan and European species.

The ribs are straight on the lateral parts but bent strongly forward in the marginal region and backward on the umbilical wall. Bifurcation of single ribs occasionally occurs in the middle of the flanks, but intercalated ribs are more frequently noticed than dichotomous ones. All the ribs terminate along the outer borders of the external keel-furrows.

Dimensions.

Diameter of the shell	115	mm.
" " " umbilicus	39	"
Height of the last volution { above the umbilical suture	50	"
" " preceding whorl	40	"
Thickness of the last volution	36	"

Sutures.—The sutures point to a close relationship with *Dittmarites Dorceus*, in which species the same type of brachyphyllic saddles and deeply serrated lobes is repeated.

Siphonal lobe shorter than the principal lateral lobe and divided by a very low median prominence. Borders of the two lateral lobes deeply incised and converging towards a median indentation which is the deepest of all. Saddles serrated up to their tops. The second lateral saddle and the auxiliary series are arranged into a tripartite suspensive lobe, this saddle and the adjoining auxiliary elements standing at an equal level.

2. DITTMARITES sp. ind. ex. aff. D. LILLI Guembel. Pl. VI, fig. 2.

The figured fragment of a body-chamber whorl from the Tropites-limestone of Tera Gádh (coll. Smith) belongs to all appearance to a species of *Dittmarites* showing great resemblance in shape and sculpture to *D. Lilli* Guembel, from the noric Hallstatt-limestone of Berchtesgaden. *D. Lilli* has been figured by E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 463, Taf. CLIII, fig. 10) and is described by this author as a species uniting the falciform ribs of *D. Dorceus* with umbilical tubercles. This pattern of sculpture is clearly developed in the present specimen.

My fragment consists of the anterior portion of the last volution, belonging entirely to the body-chamber of a large individual measuring about 90 mm. in diameter. At the proximal end of the volution the height of the cross-section is 33 mm., the width 16 mm. The umbilicus is comparatively small, much smaller than in *D. Dorceus* or in *D. Rawlinsoni*. It can scarcely have measured more than 14 mm.

The small size of the umbilicus and the more compressed shape of the cross-section are the chief features of difference between my Himálayan specimen and *D. Lilli*. The character of the sculpture would not afford any reason for separating the two species.

The sculpture consists of numerous and delicate, falciform ribs, which originate in pairs along the umbilical edge. The point of bifurcation is marked by faint, elongated tubercles, which are slightly protracted in the direction of the ribs. In the rounded marginal region the ribs are strongly curved forward and terminate very sharply along the outer border of the keel-furrow which is raised into an elevated spiral line.

The two keel-furrows are less deeply excavated and narrower than the median depression, which separates the two smooth ventral keels.

Sutures.—Only the tops of the siphonal and principal lateral saddles, forming part of the last sutural line, have been preserved. They are doliohophyllic, with deep indentations.

3. DITTMARITES TRAILLI nov. sp. Pl. VII, fig. 1.

The group of *Dittmarites Lilli* is rather richly represented in the Tropites-limestone of Tera Gádh. The collection of Mr. F. H. Smith contains a considerable number of ammonites belonging to two species, which are nearly allied to *D. Lilli*, from which they differ by rather subordinate details only.

For the larger of these two species the name of *Dittmarites Trailli* is proposed in remembrance of one of the first explorers of the snowy range of Kumaon. The entirely chambered specimen, which has been taken as the type of my illustration is sufficiently well preserved to allow all its characters of importance to be studied.

The shell is provided with high, compressed and moderately increasing whorls overlapping each other to the extent of three-fourths of their height. The largest transverse diameter of the cross-section corresponds to the umbilical margin, which is distinctly marked and rounded off very sharply. From this margin the flat lateral parts converge gradually towards the rounded siphonal area, which is not separated distinctly from the lateral parts. The two keels stand close together and the two external furrows accompanying them are comparatively low.

From *D. Lilli* Guembel this species is distinguished by its smaller umbilicus and by the less strongly marked sculpture of its siphonal area. The latter feature may also serve as a character of distinction between *D. Trailli* and the Himálayan species, which has been described as *Dittmarites sp. ind. ex. aff. D. Lilli.*

The ornamentation of the lateral parts is very similar to that in *D. Lilli*. Falciform transverse ribs and delicate umbilical tubercles are the principal elements of sculpture. The ribs are, perhaps, a little more numerous and delicate than in *D. Lilli*. They terminate abruptly along the siphonal margin. The development of faint umbilical tubercles is not confined to the last volution of full-grown individuals. In a specimen with a diameter of 24 mm. they are as distinctly marked as in my figured type-specimen. In the latter specimen the umbilicus has not been completely preserved. But, as we may judge from other examples, the pattern of ornamentation on the inner volutions within the umbilicus does not differ from that of the last whorl.

Dimensions.

Diameter of the shell		70	mm.
„ „ „ umbilicus		13	„
Height of the last volution	above the umbilical suture	35	„
	„ „ preceding whorl	24	„
Thickness of the last volution		20	„

My type-specimen is entirely chambered, but the aperture seems to coincide with the very last air-chamber. If another three-quarters of a volution are reckoned for the body-chamber the species must have attained larger dimensions than *D. Lilli*, as the diameter of the complete individual can scarcely have been less than 100 mm.

Sutures.—Very much like those of *Dittmarites Rawlinsoni.* Lobes with deep finger-like indentations, converging towards a central digitation, which is the deepest. Saddles brachyphyllic, with serrated tops.

Siphonal lobe narrow, divided by a low, median prominence, each wing terminating in a single sharp point. The two lateral lobes of nearly equal depth. Second lateral saddle and auxiliary series united into a sort of suspensive lobe. Neither the second lateral saddle nor the following sutural elements are distinctly individualised.

4. DITTMARITES TRAILLIFORMIS nov. sp. Pl. VII, figs. 2, 3.

This species is very closely related to the preceding one, both by its shape and mode of involution, and by the character of its sculpture and sutures. The two species are, indeed, so nearly allied, that if intermediate types were known, they might with equal reason be distinguished only as varieties of a single species.

My examination of a rich assemblage of specimens from Tera Gádh (coll. Smith) has convinced me that the differences between *D. Trailli* and *D. trailliformis* are not very prominent. The umbilicus is a little more widely opened in the present species and the volutions overlap each other to the extent of one-half their height only. The cross-section is less strongly compressed and the sculpture consists of less numerous, coarse ribs, which are separated by broader intercostal spaces.

Umbilical tubercles are absent or very imperfectly developed. On the other hand indistinct traces of lateral tubercles are noticed in the figured type-specimen (Fig. 2).

The sutural line agrees perfectly in the two species.

Dimensions.

Diameter of the shell		68 mm
„ „ „ umbilicus		18 „
Height of the last volution	above the umbilical suture	28 „
	„ „ preceding whorl	19 „
Thickness of the last volution		21 „

5. DITTMARITES TERAGADHENSIS nov. sp. Pl. XI, fig. 9.

The illustrated specimen from the Tropites-limestone of Tera Gádh (coll. Smith) is, in spite of its small dimensions, provided with a complete body-chamber whorl and mouth-margin. Its body-chamber measures exactly one-half of the last volution.

The species cannot be compared to the inner nuclei of *Dittmarites Ladon* v. Dittmar and its allies (*vide* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2 p. 463, Taf. CLIII, fig. 16), but its affinities point rather to the small-sized species of *Dittmarites* from the St. Cassian beds of Southern Tyrol, namely, to *D. rimosus* Muenster and *D. Sesostris* Laube. Both species have been described more fully and illustrated by E. v. Mojsisovics (Cephalopoden der Mediterranen Triasprovinz, Abhandl. K. K. Geol. Reichsanst., Bd. X, p. 60, 61, Taf. XXV, figs. 6, 11, 12 and 9, 10).

D. teragadhensis agrees with *D. rimosus* in the character of its involution and sculpture. Its whorls increase very slowly and overlap one another only along their siphonal margins. The cross-section is broad and almost rectangular, the flat lateral parts being distinctly separated from the very gently curved siphonal area by sharply rounded-off margins. The umbilicus is widely opened, but there is no marked umbilical edge, the lateral parts bending with gradually increasing convexity towards the umbilical suture. Quite close to the latter their inclination becomes perpendicular.

The two keels are raised considerably above the general level of the siphonal area. They are perfectly smooth and separated by a very low and narrow median furrow. In no other species of *Dittmarites*, indeed not even in *D. Sesostris* do the two keels stand so close to each other.

The sculpture consists of coarse ribs of unequal strength. Most of the ribs bifurcate in the umbilical region, but the point at which they originate is never marked by the presence of umbilical tubercles. The ribs are either straight or slightly falciform. They develop into faint, elongated tubercles in crossing the siphonal margin. On the siphonal area they are gradually obliterated before reaching the median keels. The median portion of the external area remains entirely smooth.

Dimensions.

Diameter of the shell	14 mm.
" " " umbilicus	6 "
Height } of the last volution	5 "
Thickness } of the last volution	6 "

Sutures.—The sutures of this small species are distinguished from those of the majority of congeneric forms by their less complicated indentations. The saddles are entire and in the lobes denticulations can be noticed only by means of a magnifying glass. The arrangement of the sutural line, however, is the same as in *D. Rawlinsoni* and its allies.

The second lateral saddle is united with the auxiliary series in a sort of suspensive lobe. The siphonal lobe is comparatively broad and is divided by a median prominence of moderate height and width. The principal lateral lobe corresponds the siphonal margin.

The expanding peristome or mouth-margin is well preserved. Its outlines follow the direction of the falciform, transverse ribs.

Remarks.—Although the two species from St. Cassian, *D. Sesostris* and *D. rimosus*, show a distant resemblance to the present form, the features of distinction between them are sufficiently well marked to exclude any close relationship.

From *D. rimosus* our species differs by its quadrangular cross-section, by its flat siphonal area and by its closely approaching keels. In *D. Sesostris* the transverse section is nearly elliptical and the lateral sculpture reaches the two siphonal keels.

Among the species of *Dittmarites* from the carnic stage of the Hallstatt beds, described and illustrated by E. v. Mojsisovics, there is none which can claim a closer comparison with the present species.

6. DITTMARITES (2) nov. sp. ind. Pl. VII, fig. 5.

From the Tropites-limestone of Kalapani (coll. Krafft) there is the fragment of the body-chamber of a *Dittmarites*, which might, perhaps, be placed near *D. Ladon* v. Dittmar (*vide* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 461, Taf. CLIII., figs. 5—8). The fragment, however, is not sufficient to establish its specific position with certainty.

Its most characteristic features are the two high, strongly individualised siphonal keels and the coarse transverse sculpture. This sculpture consists of ribs of unequal strength. The main ribs are bulky, slightly elevated along the siphonal margin and so strongly turned forward on the siphonal area that they form a sharp angle with the direction of the ribs on the lateral parts. The ribs of the second order are smaller and less prominent, but their arrangement corresponds exactly with that of the main ribs. There are two ribs of the second order intercalated between two main ribs.

The two keels stand close to each other and are separated by a median furrow, the concavity of which does not reach the general level of the siphonal area. The surface of the keels is too much injured by weathering to decide whether they were originally smooth or ornamented.

The species seems to have been provided with a wide umbilicus. The slowly increasing whorls overlap each other only up to their siphonal margins. In the cross-section the thickness of the volution slightly surpasses its height.

Dimensions.—Not measurable.

Sutures.—Not known.

Subgenus: *TRACHYPLEURASPIDITES* nov. subgen.

To the eight subgenera of *Arpadites*, which have been established by E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 450) a ninth has to be added, which is most nearly allied to the group of *Arpadites rimosi* (*Dittmarites*).

This new subgenus agrees with *Dittmarites* in the development of brachyphyllic sutures and of distinctly developed external keels, but differs from it by its more complicated sculpture. Whereas in *Dittmarites* spines or tubercles are entirely absent, they are very strongly developed in the two representatives of my new subgenus from the Tropites-limestone of Byans.

This development of several rows of tubercles, which often coincide with bifurcations of the transverse ribs, recalls the sculpture in the genus *Trachyceras* Laube. There exists, indeed, morphologically such a close similarity between *Trachypleuraspidites Griffithi* and the group of *Trachycerata valida*, that without the knowledge of the differently developed siphonal area, it could not be separated from *Trachyceras*.

1. TRACHYPLEURASPIDITES GRIFFITHI nov. sp. Pl. VI, fig. 3; Pl. XI, fig. 26.

The specimen, illustrated on Pl. VI. fig. 3, tolerably well preserved and provided with part of its body-chamber, may be taken as the type of the species, whereas the small example exhibits the character of the inner volutions, which have been partly destroyed in the larger type-specimen.

That the two specimens belong to the same species has been proved by the presence of fragments, in which parts of the outer and inner whorls are accessible to observation. Most of my specimens were collected in the Tropites-limestone of Tera Gádh by Smith; only the young individual illustrated on Pl. XI, fig. 26, comes from A. von. Krafft's collections at Lilinthi.

The young individual shows a widely umbilicated shell, consisting of numerous, rather slowly increasing whorls, which are somewhat wider than high and embrace one another on the rounded siphonal area. The umbilical margin is well defined and forms a sharp edge, in which the steep but low umbilical wall unites with the flattened lateral parts. The siphonal part is regularly rounded and passes into the flanks without distinctly defined borders. Its median region is carinated. Two rounded external keels enclose a median furrow and are accompanied by two external keel-furrows of equal width. The keels do not rise above the general level of the siphonal area.

The lateral parts are provided with numerous straight, radial ribs, all of which regularly bifurcate from strong lateral tubercles. A second series of tubercles is noticed along the umbilical margin. On the dichotomous portion of the ribs traces of marginal tubercles are occasionally met with. All the ribs terminate along the external keel-furrows, being slightly directed forward in their immediate vicinity.

This pattern of ornamentation somewhat recalls that exhibited in some species of the Jurassic genus *Reineckia, e.g.*, in *R. anceps* Rein. or in *R. Stübeli* Steinm.

In full-grown specimens the shape of the two last volutions changes in a very remarkable manner. The whorls overlap one another to more than one-half their height and increase rather rapidly in size. The transverse section becomes gradually elongated and higher than wide. But the most important character of adult individuals is the sculpture of their flanks. To the regularly bifurcating ribs single ribs are added, both occurring in almost equal numbers. The transverse ribs are narrow, rounded above and separated by broad intercostal spaces.

The spiral row of lateral tubercles, from which the dichotomous ribs bifurcate, but slightly surpasses in strength the other spiral tubercles, of which altogether nine rows have been noticed in the figured type-specimen.

The external row of tubercles is double, exactly as in a typical representative of the genus *Trachyceras*. My specimen, indeed, agrees with *Trachyceras* in its general shape and sculpture in such a remarkable way, that I should not have hesitated to identify it with this characteristic genus, but for the knowledge of its siphonal area, which, in contrast to the simple median furrow of *Trachyceras*, exhibits two sharp keels with accompanying keel-furrows along the median depression.

Dimensions.

	Pl. VI, fig. 3.	Pl. XI, fig. 24.
Diameter of the shell	98 mm.	cca. 25 mm.
" " " umbilicus	30 "	10 "
Height of the last volution { above the umbilical suture	37 "	9·5 "
Height of the last volution { " " preceding whorl	25 "	8 "
Thickness of the last volution	28 "	10 "

Sutures.—In consequence of the unfavourable state of the matrix I have not succeeded in tracing the sutural line in all its details.

The sutures are entirely brachyphyllic. The saddles show a deep denticulation of their stems. The siphonal lobe is divided by a narrow median prominence. The siphonal saddle and principal lateral lobe considerably surpass in size the rest of the sutural elements. The principal lateral saddle and adjoining lobe are comparatively small. The second lateral saddle is reduced to the size of an auxiliary element. Its inner wall touches the umbilical margin.

The number of auxiliary lobes is not known exactly, but it can only be very small, in view of the insignificant height of the umbilical wall.

2. TRACHYPLEURASPIDITES MASSONI nov. sp. Pl. VII, fig. 7.

This species differs considerably from the preceding one by its general shape and sculpture. The figured type-specimen consists of air-chambers only. In a second specimen a part of the body-chamber has been preserved. Its ornamentation agrees entirely with that of the chambered parts of the shell. Both specimens were collected by A. v. Krafft in the Tropites-limestone of Lilinthi.

The slowly increasing whorls are almost as high as broad and embrace one another only on the rounded siphonal area, up to the lateral spines, which are thus visible in the widely opened umbilicus along the spiral of involution. The umbilical margin is well defined and bordered by a steep and comparatively high umbilical wall. The siphonal area is gently rounded and not sharply separated from the lateral parts. Its sculpture consists of two low, rounded keels, which enclose a median furrow and are accompanied by a lateral keel-furrow on each side. The two keels and the three furrows are all of equal width.

The cross-section does not undergo any essential modification, as far as one can judge, from the adolescent stage of growth up to the aperture of the body-chamber.

There are numerous strong tubercles around the umbilicus. From these sharp radial ribs originate, some of them distinctly inclined forward. The ribs are ornamented by a series of indistinct lateral tubercles, beyond which there follows immediately a row of lateral spines. In the inner volutions these spines are very strongly developed, and in their shape and height recall the marginal spines in *Thetidites*. On the inner volutions this series of spines is situated in such close proximity to the external part, that it might be called either lateral or marginal with equal reason, but on the last volution it gradually approaches the median line of the lateral parts. In the meantime the spines become converted into stout tubercles.

These lateral spines and tubercles mark the places where the simple ribs regularly bifurcate. Isolated, undivided ribs, not connected with any lateral spine or tubercle, have not been noticed. All the ribs terminate along the external keel-furrows, being directed forward in their vicinity more considerably than in *T. Griffithi*.

Dimensions.

Diameter of the shell		54	mm.
" " " umbilicus		24	"
Height of the last volution	above the umbilical suture	21	"
	" " preceding whorl	18·5	"
Thickness of the last volution		22	"

Sutures.—The type of the sutures stands on the border line between brachyphyllic and dolichophyllic development.

The siphonal lobe is very narrow and provided with a high, pyramidal median prominence. The principal lateral lobe is the largest and deepest of all and almost completely fills the central portion of the flanks. It terminates in four denticulations. The siphonal and principal lateral saddles are narrow in proportion to the width of the enormous principal lateral lobe. They are strongly serrated and their upper extremities are provided with deep indentations. The second lateral saddle is very short and not well individualised. A small auxiliary lobe is divided by the umbilical suture.

In its arrangement the sutural line of the present species recalls the sutures of the genus *Dionites*, especially of *D. Cæsar* E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 489, Pl. CLV, fig. 2,) which is also characterised by its deep and very broad principal lateral lobe. The uninterrupted keels, accompanied by deep keel-furrows are, however, a feature of distinction, which excludes any closer affinity between *Trachypleuraspidites* and *Dionites*, in which two rows of fringed external ears appear instead of continuous siphonal keels.

Subgenus: *STEINMANNITES* Mojsisovics.

STEINMANNITES cf. LUBBOCKI Mojsisovics. Pl. V, fig. 4.

1896. *Steinmannites Lubbocki* E. v. Mojsisovics, Beitræge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wissensch., Bd. LXIII. math. nat. cl. p. 632, Taf. XIII, figs. 2, 3.

1899. *Steinmannites Lubbocki* E. v. Mojsisovics, Palæont. Indica, ser. XV, Himálayan fossils, vol. III, Pt. 1, p. 71, Pl. XIII, figs. 2, 3.

Among the materials collected by Smith in the Tropites-limestone of Tera Gádh a beautifully preserved specimen of an ammonite has been met with, which shows a very intimate relationship to *Steinmannites Lubbocki* Mojs. from the Halorites beds of the Bambanag range. I cannot help mentioning that to me they are only doubtfully distinguishable. Having a typical specimen of the true *Steinmannites Lubbocki* from A. v. Krafft's collection in the Halorites beds of the Bambanag section at hand for comparison, I was able to convince myself of their striking similarity. If I do not unhesitatingly refer the example from Tera Gádh to the species from the Halorites beds, it is only on account of some very subordinate features of distinction which have been noticed between them. But there is, undoubtedly, very little probability that the two could be specifically separated.

More than one-half of the last volution in my specimen belongs to the body-chamber. The whorls but slightly overlap one another, although to a somewhat larger extent than in the type-specimen from the Halorites-limestone. But in this respect the specimen collected by A. v. Krafft in the Bambanag range, is still more involute, the whorls embracing each other to a little more than one-third of their entire height.

The flanks are flat, not inflated, as in A. v. Krafft's specimen from the Halorites-limestone. This is the only point of difference in their external features. It loses, however, much of its importance, if we take into consideration that Krafft's example is entirely chambered. E. v. Mojsisovics states explicitly in his description, that "the sides are slightly inflated, but become flattened in the body-chamber."

The most characteristic peculiarity of the subgenus *Steinmannites*, the strong crenulated keels separated by a deep median furrow, is clearly marked at the beginning of the last volution only. In later stages of growth, however, the keels disappear and become completely extinct in the anterior part of the body-chamber. The median furrow remains as a shallow depression. The siphonal part is divided off from the flanks by a marginal depression, which is crossed by the transverse sculpture, whereas this sculpture is entirely interrupted by the siphonal median furrow.

The transverse sculpture consists of flexuous ribs, which are strongly bent forward in the marginal region of the flanks. The ribs are of unequal strength. Strong and broad ribs are often accompanied by delicate ones on either side. Bifurcation of the ribs outside the umbilical edge is quite an exception. Neither along the margins nor along the median furrow of the siphonal part are proper tubercles developed, but they are indicated by a swelling of the ribs on both sides of the two marginal depressions.

This sculpture is not subject to any variation throughout the last volution.

Dimensions.

Diameter of the shell		62 mm.
" " " umbilicus		17 "
Height of the last volution	above the umbilical suture	28 "
	" " preceding whorl	22 "
Thickness of the last volution		22 "

Sutures.—Unfortunately, the details of the sutural line could not be exposed intact, and as completely as might have been desirable. Nevertheless no differences from the sutures of *Steinmannites Lubbocki* have been noticed.

The shelly substance has been partly preserved. It is covered with numerous very delicate striæ of growth, running parallel to the transverse ribs. But the peculiar longitudinal sculpture, which distinguishes the group of *Steinmannites undulatostriatus*, is entirely absent. Traces of this sculpture have, however, been noticed on the shell of the specimen which was collected in the Halorites-limestone of the Bambanag range by A. v. Krafft, and which, in all its characters agrees exactly with *A. Lubbocki* Mojs.

The propriety of placing this species into the subgenus *Steinmannites* is questionable.

It has been remarked by E. v. Mojsisovics, that the present species does not strictly agree with the diagnosis of the subgenus, especially in the absence of distinct keels in the last volution. Taking into consideration the sculpture of the body-chamber, the genus *Heraclites* Mojs. may be brought into close comparison. It is chiefly *H. Albertii* Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 511, Taf. CXLI, fig. 2), which bears a close resemblance to our species, regarding the sculpture of their body-chambers, whereas the sculpture of their inner volutions differs considerably. In the last volution of *H. Albertii* the siphonal area is separated from the flanks by distinct marginal furrows, crossing the transverse ribs and thus imparting to the latter the appearance of external tubercles. The median furrow of *St. Lubbocki* is entirely absent in *Heraclites Albertii.*

There is no analogy in the sutures, which are decidedly dolichophyllic, not ceratitic, in *H. Albertii.*

In the group of *Heraclites subrobusti* a shallow median depression is often developed. This depression is bordered by a sort of longitudinal, interrupted keel on either side, consisting of distant, elongated tubercles.

I am, indeed, in some doubt, whether the present species should not be referred to the genus *Heraclites*, although I prefer to leave it with the subgenus *Steinmannites*, because the sculpture of the posterior part of its last volution makes its development from the latter more plausible.

Subgenus: *DAPHNITES* Mojsisovics.

DAPHNITES sp. ind. aff. D. UNGERI Mojs. Pl. XI, fig. 24.

The larger of the two specimens from the Tropites-limestone of Kalapani (coll. Krafft), available for examination, has been figured. Both specimens are provided with their body-chambers, to which a little more than one-half of the last volution belongs.

That this species belongs to the subgenus *Daphnites* is proved by the presence of fasciculi of falciform ribs, crossing the lateral parts and terminating sharply along the margins of a deeply-excavated siphonal furrow. The Alpine species, which seems to be most nearly allied to the present one, is *D. Ungeri* E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 485, Taf. CLII, figs. 4, 5) from the noric Hallstatt-limestone of the Sommeraukogel. Their similarity is, indeed, very great, and it is only the development of more numerous ribs within the fasciculi of *D. Ungeri*, which marks a feature of distinction between them.

The whorls are considerably higher than broad, slowly increasing, and overlap each other to the extent of one-half their height, thus leaving open a proportionately wide umbilicus. The lateral parts are very gently curved, nearly flat in the middle, and not sharply separated either from the low umbilical wall or from the gently-rounded siphonal part. Along the median line of the siphonal area a well developed furrow is excavated and bordered in the vicinity of the aperture by slightly raised keels, which gradually disappear, when approaching the chambered part of the last volution. Along this median siphonal depression the lateral sculpture is completely interrupted, the bottom of the depression remaining entirely smooth.

The sculpture of the lateral parts consists of fasciculi of falciform ribs originating in the umbilical suture. Bifurcations outside the umbilical region are extremely rare. The fasciculi are not so well individualised as in the genus *Phormedites*, the bundling of ribs being, however, as distinctly indicated as in the type-specimen of *D. Ungeri* from Hallstatt. The fasciculi are less numerous and separated by broader intercostal valleys.

The ribs are slightly falciform and directed obliquely forward in the marginal region. They are rounded above and not imbricating.

Dimensions.

Diameter of the shell		23 mm.
" " " umbilicus		6 "
Height of the last volution	above the umbilical suture	10 "
	" " preceding whorl	7 "
Thickness of the last volution		6 "

Sutures.—Ceratitic, agreeing in their general arrangement and in details with those of *D. Ungeri*.

Siphonal lobe shorter than the principal lateral lobe, and divided by a short median prominence. Bottom of the principal lateral lobe serrated, but with entire margins. Second lateral lobe very small and goniatitic. Saddles entire.

The siphonal saddle is the largest. The two lateral saddles not distinctly individualised. Only one auxiliary lobe outside the umbilical suture.

Remarks.—The affinity of this Himálayan species to *Daphnites Kittlii* Gemmellaro (I cefalopodi del Trias superiore della regione occidentalo della Sicilia 1904, p. 47, Tav. XXIX, figs. 12—17) from Monreale in Sicily is scarcely less close than to *D. Ungeri*. Our species agrees with *D. Kittlii* in the development of dichotomous falciform ribs, but in the Sicilian species the ribs are more numerous and delicate and the volutions overlap one another to a smaller extent, thus leaving open a wider umbilicus.

Subgenus: *DIONITES* Mojsisovics.

DIONITES sp. ind. ex. aff. D. CÆSAR Mojs. Pl. XI, fig. 2.

The systematic position of the figured specimen from the Tropites-limestone of Tera Gádh in the subgenus *Dionites* is ascertained by the presence of strongly developed external ears bordering the median depression, of broad ribs with spirally elongated tubercles, and of a faintly indicated reticulation on the lateral parts. Whether the shell was provided with lines of growth independent from the direction of the ribs or not, must remain unknown, as my specimen is a cast devoid of its shelly substance. Nor have I been able to decide whether it is chambered throughout or possesses a part of its body-chamber, its internal structure having been completely destroyed.

The specimen belongs, in all probability, to a species very closely allied to *Dionites Cæsar* E. v. Mojsisovics (Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 489. Taf. CLIV, fig. 11; CLV, fig. 2; CXCIII, fig 4) from the noric stage of the Hallstatt-limestone, but on account of its incompleteness it is preferable to refrain from the introduction of a new specific name.

In its involution the present specimen agrees with the type illustrated by E. v. Mojsisovics on Pl. CLIV, fig. 12, and described as *Dionites nov. form. ind.* which is of nearly equal size. The volutions embrace one another to a very large extent, leaving only a narrow umbilicus open, and are considerably higher than broad. The umbilicus is surrounded by a high and perpendicular umbilical wall, but the umbilical margin is steeply rounded, but not raised into a vaulted elevation as in full-grown individuals of *D. Cæsar*. The siphonal area is regularly arched and interrupted along the median line by a deeply excavated depression.

The sculpture consists of broad, anteriorly turned ribs, which terminate in strong, spirally protracted external ears. The ribs are broader than the intercostal furrows. They increase either by bifurcation in the middle of the height of the lateral parts or by intercalation of new ribs. Most of the ribs are dichotomous.

It is difficult to state the exact number of spiral rows of tubercles, as my specimen has been partly injured by weathering. There are, however, at least five rows present. But the lateral tubercles are not the predominant element of sculpture and are never as strongly developed as in the examples of *D. Cæsar* figured by E. v. Mojsisovics.

Most of the tubercles are spirally elongated. Thus a spiral striation of the cast is indicated, where the single tubercles are obliterated. The external ears considerably surpass the lateral tubercles in size and strength, but are not united into crenulated keels, as in *D. Caroli* Mojs.

Dimensions.

Diameter of the shell	32	mm.
" " " umbilicus	3·5	"
Height of the last volution { above the umbilical suture	18	"
" " preceding whorl	11	"
Thickness of the last volution	10·5	"

Sutures.—Not known.

Subgenus: *DREPANITES* Mojsisovics.

1. DREPANITES sp. ind. ex aff. D. MARSYAS Mojs. Pl. VIII, fig. 17.

A species which is represented in A. v. Krafft's collection from Kalapani by two incomplete specimens, is very nearly allied to *Drepanites Marsyas* E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 500, Taf. CL, fig. 2) from the noric stage of the Hallstatt-limestone.

Both specimens are of small size only, although they are mature individuals, being provided with a part of their body-chambers. The whorls embrace one another almost completely, and are strongly compressed, leaving only a very small umbilicus open. The shell is flat, discoidal, with a high and narrow transverse section. The lateral parts are flat, barely curved at all and devoid of ornamentation. The siphonal part is provided with a deep median furrow and separated from the flanks by smooth, steeply-rounded margins.

In the shape of the siphonal area, especially in the absence of marginal tubercles or crenulations, this species closely agrees with *D. Marsyas*, which, however, differs by its distinct, though very delicate, ornamentation of the lateral parts.

The measurements of the figured specimen are as follows:—

Diameter of the shell	22·5	mm.
" " umbilicus	1·5	"
Height of the last volution { above the umbilical suture	13·5	"
" " preceding volution	9·5	"
Thickness of the last volution	7	"

Sutures.—By means of a magnifying glass the sutures are seen to exhibit a brachyphyllic serration, affecting the saddles up to the extremities of their tops.

The siphonal lobe is broad and provided with deep indentations; one of these, which coincides with the rounded marginal edge, reaches almost to the height of the median prominence. The principal lateral lobe is the deepest. Two auxiliary lobes and saddles are noticed outside the umbilical suture.

In its general arrangement the sutural line agrees with that of *D. Hyatti* Mojsisovics (l. c. Taf. CLI, fig. 10).

2. Drepanites Schucherti nov. sp. Pl VI, fig. 8.

In the subgenus *Drepanites* this and the following species represent a distinct group, differing considerably from other congeneric forms.

The shell is flat, discoidal and very strongly compressed. The slowly increasing volutions overlap one another to the extent of one half of their height only. Thus a comparatively wide umbilicus is formed, of much larger dimensions than in any of the species of *Drepanites* hitherto described.

The lateral parts are nearly flat, and separated from the steep umbilical wall by a well-marked, somewhat rounded umbilical edge. Parallel to this edge, and at a short distance from it, a blunt spiral elevation is noticed It is the only distinct interruption in the otherwise smooth surface of the inner portion of the last volution.

The siphonal area is narrow, deeply excavated and bordered by two marginal keels, resembling the marginal keels in *D. fissistriatus* Mojs. or in the genus *Hauerites.*

The ornamentation is but faintly marked, at least in the cast, my only specimen available for examination being almost entirely devoid of its shelly substance. In the inner volutions moderately strong, broad ribs are noticed, which rise at the umbilical edge But the ribs disappear gradually, as they approach the beginning of the last volution. The umbilical portion of this volution is smooth, but in the marginal portion numerous delicate and falciform ribs make their appearance. These falciform ribs cross the external keels and impart to them a crenulated shape, their low elongated tubercles corresponding to the ribs, and the depressions between two tubercles to the intercostal furrows.

This pattern of ornamentation strongly recalls the sculpture of *D Hyatti* Mojs.

Dimensions.

Diameter of the shell		50 mm
„ „ „ umbilicus		11 „
Height of the last volution	above the umbilical suture	22 „
	„ „ preceding whorl	16 „
Thickness of the last volution		8·5 „

Sutures.—Nearly one-half of the last volution belongs to the body-chamber. The development of the sutures is distinctly brachyphyllic. The lobes are provided with deep, finger-like indentations, affecting the walls of the saddles up to the middle of their height. The upper extremities of the saddles are faintly serrated.

The siphonal lobe is deep and provided with a very broad median prominence, reaching across the entire siphonal area. A remarkable indentation in this prominence coincides with the marginal keel. Each wing of the siphonal lobe is bifid. The siphonal and principal lateral saddles are of nearly equal height. Even the small second lateral saddle is denticulate up to its top. The short auxiliary lobe is divided by the umbilical suture.

Locality.—Number of specimens examined. The only specimen known to me, comes from the Tropites-limestone of Lilinthi, where it was collected by the late Dr. A. v. Krafft.

Remarks.—The characters, in which this species chiefly differs from the representatives of the genus *Drepanites* in the Alpine Trias, described by E. v. Mojsisovics, are the strongly compressed, high-mouthed transverse section, the proportionately wide umbilicus, and the absence of an auxiliary series in the sutures. There is, however, no other genus, to which equally close affinities exist. In its external shape, it is true, my species also recalls *Haueritea* Mojs., but from this genus it is at once distinguished by its brachyphyllic sutures. From *Paratibetites* it is distinguished by the shape of its cross-section as well as by the arrangement of its sutural line. A similar remark applies to *Cyrtopleurites* and *Anasirenites*.

Although this and the following species constitute a peculiar, well-defined group in the Indian Trias, I do not think the introduction of a new subgeneric name advisable, in view of the scarcity of my materials available for examination.

3. Drepanites Eastmani nov. sp. Pl. VI, fig. 9.

This species, of which I possess only one individual from Lilinthi (coll. Krafft), is very nearly allied to the preceding one. In general shape and sculpture they agree so perfectly that, without a knowledge of their sutures, I should not have hesitated to identify them.

My type-specimen is provided with its body-chamber, to which a little more than one-half of the last volution belongs. Its measurements are as follows:—

Diameter of the shell		44 mm.
" " " umbilicus		9·5 "
Height of the last volution	above the umbilical suture	20·5 "
	" " preceding whorl	15 "
Thickness of the last volution		9 "

The sculpture is somewhat more distinctly marked than in the preceding species; but this is probably due merely to its state of preservation.

Sutures.—The sutural line agrees with that of *D. Schucherti* in the general arrangement of its elements, but differs considerably from it in its less complicated structure. The saddles are not serrated. The siphonal and principal lateral lobes are provided with ceratitic indentations at their base. The second lateral lobe terminates in a simple, sharp point. There is no auxiliary lobe.

This difference in the structure of the sutures is certainly not due to a weathering of the cast, as I have myself taken off a fragment of the shell adhering to the very last air-chamber and have thus succeeded in developing a perfectly fresh exposure of the two lateral lobes.

Genus: CYRTOPLEURITES Mojsisovics.

E. v. Mojsisovics regarded the genus *Tibetites* as the Indian Triassic representative of the European *Cyrtopleurites*. No representatives of the genus *Cyrtopleurites* were known to him in the fauna of the Halorites-limestone of the Bambanag range. In the Tropites-limestone of Byans two species with fringed external ears occur together with representatives of the genus *Tibetites*. These two species, characterised by the distinguishing features of *Cyrtopleurites*, must consequently be classed with the latter genus. Both of them are nearly allied to *C. Agrippinæ* Mojs., from the noric stage of the Hallstatt-limestone.

1. CYRTOPLEURITES FRESHFIELDI nov. sp. Pl. VIII, figs. 9, 10, 11, 12.

The individual variations, to which this species is subject in respect of size and ornamentation, are of some importance. There are, however, transitional forms between the extreme types, so that there can be no doubt that they are specifically identical. The rich materials of this species, which have been collected at Tera-Gádh by Smith, and at Lilinthi by Smith and A. von Krafft, prove it to be one of the more important leading fossils of the Tropites-limestone of Byans.

The volutions increase slowly, overlapping each other considerably and enclosing an umbilicus of rather variable dimensions. Some difference in this respect is exhibited by the two extreme individuals, which have been illustrated in figs. 9 and 10. The lateral parts are flatly arched, their greatest distance being situated in the lower portion of the cross-section. A well-marked, somewhat rounded umbilical edge separates the flanks from the low but steep umbilical wall.

The sculpture of the lateral parts consists of numerous falciform ribs, with rounded tops and broad intercostal depressions. From the umbilical edge towards the marginal region the number of ribs increases equally by bifurcation of the primary ribs and by intercalation of new ones. Dichotomous and intercalated ribs do not alternate regularly. In some specimens dichotomous ribs are but rarely met with, whereas in others they are the predominating element of sculpture.

Tubercles occasionally mark the spots where a bifurcation takes place. Exceptionally tubercles also occur in the vicinity of the umbilical region, as for instance on the specimen illustrated in fig. 9, but in general the development of tubercles on the flanks is but a subordinate detail and not an essential feature of the ornamentation. In this respect almost every specimen differs from the others, and, if anybody should wish to attribute to this character a specific importance, he would be obliged to introduce as many separate species as there are individuals.

There are, however, two series of tubercles regularly developed in all my examples available for examination. Two of them border the deeply excavated furrow of the siphonal area. They are followed on each side by a lower row of equally prominent tubercles, corresponding to the external margin. The tubercles of the siphonal rows are longitudinally produced and shaped into small, parabolic "ears." By means of a magnifying glass it is easy to see the notchings of their edges, so characteristic of the genus *Cyrtopleurites*. The fringed character of the ears, it is true, is but faintly marked in the present species, but still sufficiently well to exclude its reference to *Tibetites*, which is distinguished by the absence of any notchings in the external ears.

The elongated external ears persist up to the anterior end of the body-chamber, whereas the marginal tubercles gradually diminish in strength and finally become obliterated. As a rule the siphonal furrow is perfectly smooth, but exceptionally (fig. 10) faint traces of transverse bands are noticed, crossing the depressions between two external ears.

Dimensions.

	Fig. 9.	Fig. 11.
Diameter of the shell	31·5 mm.	42 mm.
„ „ „ umbilicus	8 „	6 „
Height of the last volution above the umbilical suture	18 „	22 „
Height of the last volution „ „ preceding whorl	15 „	18 „
Thickness of the last volution	8·5 „	13 „

Sutures.—The sutures are rather ceratitic as in *Tibetites*, than brachyphyllic or dolichophyllic, as in the few representatives of *Cyrtopleurites*, the sutures of which have been illustrated by E. v. Mojsisovics. They approach the sutures of *Tibetites Ryalli* Mojs. or *Anatibetites Kelvini* Mojs., but the saddles are larger, more slender and faintly serrated along their margins. As in the two species mentioned from the Halorites-limestone a small denticle is separated from the siphonal saddle by a deep indentation. A single auxiliary lobe is situated outside the umbilical suture.

2. CYRTOPLEURITES sp. ind. ex aff. C. AGRIPPINÆ, Mojs. Pl. VIII, fig. 13.

This fragment of a body-chamber appears to be closely allied to *Cyrtopleurites Agrippinæ* E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 519, Taf. CLXVII, fig. 22), especially with reference to its sculpture.

The sculpture consists of numerous broad, falciform ribs, which are flatly rounded above and separated by intercostal valleys of equal width. In the anterior portion of the fragment the ribs are packed together more closely and are less broad. Bifurcations of the ribs occur in the vicinity of the umbilicus and in the middle of the lateral parts. Intercalated ribs are comparatively rare. The places, where bifurcations of the ribs occur, are never marked by the development of spines or tubercles. The transverse sculpture extends, though faintly marked, across the broad siphonal furrow. This furrow is bordered on either side by a row of ears which are distinctly fringed and exhibit two or three denticulations. A marginal row of low, elongated tubercles is less distinctly developed.

As far as one can judge from this fragment, the present species seems to differ from *C. Agrippinæ* by the greater number of ribs only.

The figured specimen, collected in the Tropites-limestone of Lilinthi by A. v. Krafft, does not permit exact measurements of its dimensions. The height of the volution near its peristome is 32 mm., its thickness 16 mm.

Genus: TIBETITES Mojsisovics.

TIBETITES cf. RYALLI Mojsisovics, Pl. VIII, fig. 4.

1896. *Tibetites Ryalli*, E. v. Mojsisovics, Obertriadische Cephalopoden faunen des Himalaya, Denkschr. Kais. Akad. d. Wiss. LXII, p. 687. Taf. XV, figs. 3, 4.

1899. *Tibetites Ryalli* E. v. Mojsisovics, Palæont. Indica, ser. XV. Himal. Foss., Vol. III, Pt. 1, Upper triassic Cephalopod faunae of the Himálayas, p. 77, Pl. XV, figs. 3, 4.

Among the numerous ammonites from the Tropites-limestone of Byans, which belong to this genus, *Tibetites* (*sensu stricto*) is represented by a single specimen only, which was collected by the late Dr. A. v. Krafft.

To *Tibetites* (*s. s.*) such species only have been attributed by E. v. Mojsisovics, in which the shape and sculpture of the body-chamber agree entirely with those of the chambered parts of the shell. To this type the figured specimen from Lilinthi undoubtedly belongs. Notwithstanding its small size it is provided with its body-chamber. As regards its shape and ornamentation, there is no difference between the body chamber and the rest of the shell. The spiral rows of external, not "fringed", ears, of marginal and of lateral tubercles continue without any interruption.

The figured specimen agrees perfectly and in every respect with the description and illustration of *Tibetites Ryalli*, as given by E. v. Mojsisovics. In its dimensions it agrees with the specimen (fig. 3) from the Halorites-limestone of the Bambanag range. Its measurements are as follows :—

Diameter of the shell		29·5 m.m.
,, ,, ,, umbilicus		5 ,,
Height of the last volution	above the umbilical suture	15·5 ,,
	,, ,, preceding whorl	10·5 ,,
Thickness of the last volution		12 ,,

The shell is provided with broad and stout ribs, which run in a straight direction from the deeply depressed umbilicus towards the siphonal margin. Dichotomous and intercalated ribs are developed in nearly equal numbers. A good character of the species is the equal strength which all the ribs attain in the vicinity of the outer margin. The lateral and marginal tubercles are very strong. Two marginal tubercles correspond regularly to one external tubercle. The lateral tubercles are conical, the marginal tubercles spirally elongated. The external ears form high, much protracted prominences of parabolic outlines.

Sutures.—The arrangement of the sutures is nearly the same as in the type-specimen of *Tibetites Ryalli* figured by E. v. Mojsisovics (p. 78). The only difference consists in a little more slender shape of the saddles in my example from Lilinthi. The outer lappet of the bipartite siphonal saddle is consequently more distinctly separated from the main portion of that saddle. The details of the auxiliary series are not known to me.

Remarks.—Species similar to *Tibetites Ryalli* are not restricted to the Halorites-limestone but make their appearance in lower horizons of the Bambanag section. *Tibetites sp. ind.* Mojsisovics (l. c. p. 80) is a form very nearly allied to *T. Ryalli*. It can, however, not be identified with my specimen from Lilinthi, which in the strength of its sculpture agrees perfectly with T. *Ryalli*, whereas the carnic species from the Daonella beds of the Bambanag range is more delicately ribbed and therefore more richly ornamented.

It is only by reason of slight differences in the details of the sutural line that I do not venture on a direct identification of the present specimen with *T. Ryalli*.

Subgenus: *ANATIBETITES* Mojsisovics

1. ANATIBETITES KELVINI Mojsisovics. Pl. VIII, figs. 1, 2.

1896. *Anatibetites Kelvini*, E. v. Mojsisovics, Beitraege zur Kenntniss der obertriadischen Cephalopodenfaunen des Himalaya, Denkschr. Kais Akad. Wiss., Bd. LXIII, p. 639, Taf. XIV, fig. 9.

1899. *A. Kelvini* E. v. Mojsisovics, Palæontologia Indica, ser. XV, Himálayan Fossils, Vol. III., Pt. 1, p. 80, Pl. XIV, fig. 9.

In the Himálayan collections of Smith and A. v. Krafft from Lilinthi and Tera Gádh this species is rather richly represented. Most of the specimens are provided with their body-chambers and agree morphologically with the type-specimen from the Halorites-limestone of the Bambanag section, illustrated by E. v. Mojsisovics. The specimen represented in fig. 1 is a good example of this type.

In this specimen more than one-half of the last volution belongs to the body-chamber. The ventral area is moderately inflated and sharply separated from the lateral parts. The two rows of external ears, which are still distinctly marked in the anterior portion of the body-chamber, gradually disappear, and are completely absent in the vicinity of the peristome. The elongated marginal tubercles continue across the entire shell, although they are weakened considerably near the aperture.

The sculpture of the lateral parts is formed by strong ribs, which rise from the umbilical margin and run in a nearly straight direction as far as the stout and conical lateral tubercles. The row of lateral tubercles corresponds exactly to the central line of the flanks. In the lateral tubercles most of the primary ribs bifurcate, but at the same time they are considerably weakened. Thus in the strength of sculpture a remarkable difference is exhibited between the inner and outer parts of the flanks.

From this type, to which the majority of my examples corresponds, a variety, which has been illustrated in fig. 2, differs in several details. In spite of its small dimensions this specimen is provided with the beginning of its body-chamber. In the vicinity of the aperture a lowering of the external ears gradually sets in, thus justifying the reference of the specimen to *Anatibetites*, rather than to *Tibetites* (*s. s.*) In its moderately wide umbilicus this specimen corresponds to the septate inner volutions of the typical form of *A. Kelvini*. The ribs are not straight but of falciform shape and are only a little less strongly developed on the outer than on the inner portion of the sides. The ribs increase in number not only by bifurcation, but also by intercalation of new ones. I consider all those details to be of such subordinate importance, that there is no reason to separate this variety from the typical form as a true species.

Dimensions.

	Fig. 1.	Fig. 2.
Diameter of the shell	48 mm.	35 mm
" " " umbilicus	6 "	7 "
Height of the last volution { above the umbilical suture	26·5 "	16 "
" " preceding whorl	17·5 "	12 "
Thickness of the last volution	15 "	12 "

Sutures.—There is no difference between the arrangement of the sutural line of my examples and that of the type-specimen illustrated by E. v. Mojsisovics in fig. 9*d*. The development of a secondary denticle in the siphonal lobe, the quadrangular shape of the broad and comparatively low saddles, imitating the type of sutures of the Ceratites of the German Muschelkalk, and the presence of a number of auxiliary lobes, varying from two to three, is distinctly marked in all my examples from the Tropites-limestone of Byans.

Remarks.—It is to this species that *Palicites Mojsisovicsi* Gemmellaro (I cefalopodi del trias superiore della regione occidentale della Sicilia, p. 56, Tav. XIV, figs. 15-18) from Palazzo Adriano seems to bear the greatest external resemblance. The different development of the sutural line in *Palicites* justifies, however, the introduction of a new subgenus for the accommodation of the Sicilian type.

2. ANATIBETITES HOBSONI nov. sp., Pl. VI, fig. 1.

Among the materials collected by A. v. Krafft near Kalapani a single but fairly well preserved specimen of an ammonite has been discovered, which in its general shape, involution and sculpture closely imitates the group of *Heraclites robusti* from the Alpine Trias, but differs from them by the presence of ceratitic sutures and must undoubtedly be classed not with *Heraclites* Mojs. but with *Anatibetites*.

At first glance my specimen strongly resembles a typical Ceratite of the group of *nodosi* from the Alpine or Himálayan Muschelkalk. The whorls are moderately involute and increase rather rapidly in height and thickness. They overlap each other to the extent of nearly two-thirds of their height. The height of the last whorl increases from 16 to 38 mm., the thickness from 15 to 33 mm. The lateral parts are strongly convex and are bent towards the umbilicus in a steep curve without the intervention of a distinct umbilical margin. The siphonal area is flat and sharply separated from the lateral parts, as in *Ceratites Kamadeva* Dien. or in *Ceratites Kuvera* Dien. from the Indian Muschelkalk.

In the posterior portion of the body-chamber the siphonal area is raised into the form of two low keels consisting of small, elongated tubercles. These keels gradually diminish in size, as we approach the body-chamber portion of the specimen, which comprises a little more than one-third of the last volution. In the anterior region of the body-chamber the keels are entirely lost.

This is exactly the typical sculpture of a *Heraclites* of the *robusti*-group, as it has been described by E. v. Mojsisovics. But an equally great morphological agreement exists between our specimen and *Anatibetites*.

The sculpture of the lateral parts consists of low, broad ribs, terminating near the siphonal margin in well-marked and protracted, semilunular tubercles. A second row of tubercles rises on the lateral parts a little above the lower third of their height. They form high, conical prominences, in which a bifurcation of the ribs regularly occurs. Thus the number of marginal tubercles is exactly double the number of lateral tubercles. In the last volution of my specimen 8 lateral tubercles correspond to 16 marginal ones.

From the lateral tubercles the ribs run less distinctly towards the umbilical suture, without rising into a third, umbilical series of tubercles. In general the stout tubercles are a far more prominent element of sculpture than the transverse ribs.

The shelly substance, as far as preserved, is covered with very delicate transverse striæ of growth only.

Dimensions.

Diameter of the shell		71·5 mm
„ „ „ umbilicus		15 „
Height of the last volution.	above the umbilical suture	38 „
	„ „ preceding whorl	26·5 „
Thickness of the last volution		33 „

Sutures.—The arrangement of the sutures is very similar to that in a typical *Ceratites* of the Muschelkalk. The lobes are deeply serrated at their base, but the denticulation affects the marginal walls of the saddles only in the lower half of their height. The large, rounded saddles are of nearly equal height and are not serrated in their upper portions.

The siphonal lobe is less deep than the principal lateral lobe and is divided by a short median prominence. The siphonal saddle coincides with the marginal, and the principal lateral saddle with the lateral, tubercles.

The second lateral lobe is very short. The small second lateral saddle is followed by a broad umbilical lobe, in which one flat auxiliary saddle is distinctly individualised.

Remarks.—The genus *Heraclites*, according to the diagnosis given by

E. v. Mojsisovics, includes shells with ceratitic outlines and sculpture and with brachyphyllic or dolichophyllic sutures. The group of forms, to which our Himálayan specimen is most nearly allied, if the difference in the sutural line is not taken into consideration, is the group of *Heraclites robusti*. *Heraclites Bellonii* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 507, Taf. CXXXIX, fig. 10) exhibits a very similar pattern of sculpture, consisting of low and interrupted siphonal keels and of strongly developed lateral and marginal tubercles, which are connected by bifurcating ribs. In the development of the sutural line, however, the group of *Heraclites robusti* differs remarkably from *Anatibetites Hobsoni*, their saddles being provided with deep digitations, imparting to them a very characteristic shape, such as is seen in scarcely any other Triassic ammonite. In the group of *Heraclites suavicostati* the saddles seem to be less deeply serrated, but in this group there is only one species of which the sutures have been figured by E. v. Mojsisovics, whereas the sutures of four species are entirely unknown.

The only subgenus amongst the representatives of which the present species can be classed, is *Anatibetites*. This subgenus, which E. v. Mojsisovics genetically referred to *Tibetites*, unites the sculpture of *Heraclites* with sutures reminding us greatly of the type of sutures of the Ceratites of the German Muschelkalk. The only species hitherto known is *Anatibetites Kelvini* Mojs. From this species *A. Hobsoni* is easily distinguished by its wide umbilicus and by its less numerous but more prominent tubercles. It approaches, indeed, still more closely the type of *Heraclites robusti* than *A. Kelvini*.

A. von Krafft in his preliminary report on the results of the survey-work in Spiti in 1899 (General Report, Geol. Surv. of India, for 1899-1900, p. 218) remarks that ammonites with the external characters of *Heraclites* but with ceratitic sutures have been discovered in a nodular limestone with *Tropites sp.* There is a great probability that these ammonites also belong to the subgenus *Anatibetites*.

Subgenus: *PARATIBETITES* Mojsisovics.

1. PARATIBETITES ADOLPHI Mojsisovics, Pl. VIII, fig. 8.

1896. *Paratibetites Adolphi* E. v. Mojsisovics, Beitræge zur Kenntniss der obertriadischen Cephalopoden-faunen des Himálaya. Denkschr. Kais. Akad. d. Wiss, math. nat. Cl., Bd. LXIII, p. 672, Taf. XV figs. 7-10.

1899. *P. Adolphi* E. v. Mojsisovics, Palæontologia Indica, ser. XV, Himálayan Fossils, Vol. III, Pt. 1, p. 84, Pl. XV, figs. 7-10.

Three specimens collected by Smith in the Tropites-limestone of Tera Gádh agree perfectly with *Paratibetites Adolphi* from the Halorites beds of the Bambanag range in shape, involution and sculpture.

In the figured specimen, which is the most complete, more than one-half of the last volution belongs to the body-chamber.

In its size and ornamentation this specimen stands between the two examples illustrated by E. v. Mojsisovics in fig. 7—which is to be regarded as the prototype of the species—and fig. 10. It attains the features of maturity while still smaller dimensions than the type fig. 7, but of larger size than the type fig. 10.

At the beginning of the last volution the two rows of interrupted external ears are as distinctly marked as in *Tibetites* (*s. s.*). It is only after the last still septate portion has been reached, that these ears are united into sharp keels accompanying an excavated median furrow. Towards the peristome this median furrow gradually disappears, the two keels approach each other, and the siphonal part assumes the shape of a blunt edge. Simultaneously with this variation of the siphonal part the lateral transverse sculpture becomes weaker. The marginal and lateral tubercles also diminish in size and strength, but the spiral lines, along which they are arranged, still form continuous ridges.

Dimensions.

Diameter of the shell		50·5 mm.
„ „ „ umbilicus		8·5 „
Height of the last volution	from the umbilical suture	29 „
	„ „ preceding whorl	21 „
Thickness of the last volution		15 „

Sutures—Not known in detail.

2. PARATIBETITES cf. BERTRANDI Mojsisovics, Pl. VIII, fig. 3.

1896. *Paratibetites Bertrandi* E. v. Mojsisovics, Beiträge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wissensch. math. nat. Cl., Bd. LXIII, p. 641, Taf. XV, fig. 1.

1899. *P. Bertrandi* v. Mojsisovics, Palæontol. Indica, ser. XV, Himálayan Foss., Vol. III, Pt. 1, p. 82, Pl. XV, fig. 1.

The fragment of a species of *Paratibetites* from Lilinthi (coll. Krafft) agrees in its general features with *P. Bertrandi* Mojsisovics from the Halorites-limestone of the Bambanag range in such a remarkable way that I should not have hesitated to identify it with this noric species, but for its rather incomplete state of preservation.

The specimen is characterised by its remarkably strong sculpture. There are nine ribs in the circumference of the last volution, exactly as in the type-specimen from the Halorites beds. Each of these ribs is divided into two bifurcating ribs outside the lateral tubercles. There is only one intercalated rib present within the zone formed by the spirals of the lateral and marginal tubercles. Thus the number of marginal tubercles is double the number of lateral ones. The bifurcating ribs never attain the strength of primary ribs.

The two rows of external ears are arranged very closely to each other and form together a sort of crest along the centre of the roof-shaped siphonal area, which is distinctly separated from the lateral parts by the spiral rows of marginal tubercles.

The sutures of this specimen are not known to me in detail. Its dimensions are not measurable on account of the defective state of preservation of the fragment.

8. PARATIBETITES cf. GEIKIEI Mojsisovics. Pl. XIV, fig. 8.

1896. *Paratibetites Geikiei* E. v. Mojsisovics, Beitræge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya. Denkschr. Kais. Akad. d. Wissensch. math. nat. Cl., Bd. LXIII, p. 642, Taf. XV, fig. 2.

1899. *P. Geikiei* v. Mojsisovics, Palæont. Indica, ser. XV, Himálayan Foss., Vol. III, Pt. 1, p. 83, Pl. XV, fig. 2.

A somewhat fragmentary specimen of *Paratibetites* from the Tropites-limestone of Lilinthi (coll. Krafft), consisting of air-chambers only, differs from *P. Bertrandi* by such modifications in the sculpture and sutures as induced E. v. Mojsisovics to introduce *P. Geikiei* as a separate species. If by reason of the characters enumerated by this author the specific validity of *P. Geikiei* be accepted as sufficiently established, there can be little doubt as to the connection of the present specimen from Lilinthi with the species of the Halorites-limestone.

Although in its general characters agreeing with *P. Bertrandi* my example is provided with a higher transverse section, with a larger number of ribs, which are crowded together more closely but are less strongly developed, and further differs by the development of undulating keels separated by a median siphonal furrow.

Seven ribs are counted in one-half the circumference of the last volution. Intercalated ribs occur more commonly than in *P. Bertrandi*. They are not straight but decidedly falciform, being directed backwards outside the spiral line of lateral tubercles and strongly bent forward in the marginal region. The external ears are united into two external keels, which are situated very close to each other and separated by a very low and narrow median furrow.

Dimensions.

Diameter of the shell	56·5 mm.
„ „ „ umbilicus	4 „
Height of the last volution above the umbilical suture	27 „
Height of the last volution „ „ preceding whorl	2 „
Thickness of the last volution	17 „

Sutures.—The siphonal lobe is provided with a broad median prominence, from which an inner lappet is separated by a deep indentation. Both this lappet and the central part of the median prominence are rounded above. The outer lappet of the siphonal saddle is considerably shorter than the top of the latter. Small denticulations affect the marginal walls of the main saddles up to their summits, which alone remain entire, but the serration is not sufficiently strong to impart to the sutures a decidedly brachyphyllic shape.

4. PARATIBETITES sp. ind. aff. P. TORNQUISTI Mojs.

For the sake of completeness mention must be made here of a large fragment of a species of *Paratibetites*, which may be compared with *P. Tornquisti* E. v. Mojsisovics (Palæont. Ind., ser. XV, Vol. III, Pt. 1, p. 87, Pl. XVI, fig. 5).

This specimen from the Tropites-limestone of Nihal (coll. Smith), which is provided with a portion of its body-chamber, is chiefly remarkable for its bluntly-pointed external edge. The lateral parts are perfectly smooth. Neither sigmoidal folds nor tubercles are indicated.

The specimen is not sufficiently good for illustration. Its sutures are not known to me.

Dimensions—Not measurable.

5. PARATIBETITES WHEELERI nov. sp. Pl. VIII, figs. 5, 6, 7.

This is a very interesting species recalling *Paratibetites angustisellatus* Mojs. and *P. Tornquisti* Mojs., but distinguished from them by its sharp, knife-shaped median edge.

There are altogether three specimens available for examination. Two were collected in the Tropites-limestone of Lilinthi by the late A. v. Krafft; the third comes from Kalapani.

The most complete specimen, which therefore may be taken as the type of the species, is that illustrated in fig. 6. It is subject to stronger ontogenetic modifications occurring in the course of the last whorl than all the other congeneric species.

At the beginning of the last volution the specimen is very similar to *P. Bertrandi* Mojs. when full-grown. The sculpture of the lateral parts consists of undivided, straight ribs running from the umbilical margin to the large lateral tubercles where they bifurcate. From the row of marginal tubercles the siphonal area rises steeply, roof-like, towards the narrow crest, which is bordered by two rows of external ears standing very closely to each other.

From this stage of development *Paratibetites Wheeleri* passes rather rapidly into a stage characterised by the fusion of the two rows of external ears into a sharp edge. This stage is accompanied by a gradual weakening of the lateral sculpture. The ribs diminish remarkably in strength, whilst the lateral and marginal tubercles persist. This stage continues in the illustrated specimen as far as the anterior part of the last volution, which consists of air-chambers only.

The last stage of development is exhibited in the specimen illustrated in fig. 5, one-half of which belongs to the body-chamber. The body-chamber differs from the chambered part of the last volution by its helmet-shaped siphonal crest and by the absence of any distinct transverse sculpture.

The siphonal area, which in earlier stages of growth forms a roof-like crest with a sharp median keel, is elevated into a very high and steep edge, which is but indistinctly separated from the flanks by spiral ridges corresponding to the rows of marginal tubercles. Both the lateral and marginal tubercles persist, more or less weakened, as far as the aperture of the body-chamber, but of the transverse ribs faint traces only are still noticed.

This species is provided with a very narrow umbilicus recalling *P. angustisellatus.*

Dimensions (type-specimen, fig. 6).

Diameter of the shell		48 mm.
„ „ „ umbilicus		2·5 „
Height of the last volution	above the umbilical suture	25 „
	„ „ preceding whorl	17 „
Thickness of the last volution		14 „

Exact measurements of the body-chamber specimen illustrated in fig. 5 cannot be given. To a height of 41 mm. a thickness of 16 mm. and a diameter of the umbilicus of 8 mm. correspond.

Sutures.—The sutural line closely agrees in its arrangement with the sutures of *Paratibetites angustisellatus* E. v. Mojsisovics (Palæont. Indica, ser. XV, Vol. III, Pt. 1, Pl. XVI, fig. 4), but is still more complicated. Its character is decidedly dolichophyllic and the outer lappet of the bipartite siphonal saddle assumes the shape of a proper adventitious saddle. In this respect the sutures of the present form approach very nearly those of the Himálayan species from the "Haucrites" limestone of the Bambanag section, which has been described as Hauerites *sp. ind.* by E. v. Mojsisovics, but which most probably belongs to the genus *Carnites* or to *Paratibetites.*

The deep siphonal lobe is provided with a broad median prominence, which itself is again divided by two corresponding indentations into a short central body and into two saddle-like lappets on both sides. On the inner side of the siphonal lobe there rises a high, adventitious saddle, corresponding to the outer lappet of the bipartite siphonal saddle in the majority of species of *Paratibetites.* This saddle is separated from the main mass of the external saddle by a deep adventitious lobe and is provided with large notches imparting to it a decidedly dolichophyllic character. The siphonal and principal lateral saddles are of nearly equal height and serrated up to their very tops.

The second lateral saddle is followed by three auxiliary lobes outside the umbilical suture.

The tendency to a dolichophyllic development of the sutures, which are ceratitic or brachyphyllic in the majority of species of *Paratibetites,* is especially well marked in the outer walls of the adventitious and principal lateral saddles and in the stem of the siphonal saddle.

Genus: ACANTHINITES Mojsisovics.

The genus *Acanthinites,* which in the Trias of the Eastern Alps is restricted to the noric stage of the Hallstatt-limestone, is represented in the fauna of the Tropites-limestone of Byans by two species, one of them being perhaps closely allied to *Acanthinites excelsior* v. Mojsisovics, whereas the second holds a rather isolated position, on account of some characters, which recall *Protrachyceras* and

Trachysagenites. The second species deserves to be elevated to the rank of a true subgenus.

ACANTHINITES HOGARTI nov. sp. Pl. IX, figs. 1, 3.

The specimen from Tera Gádh (coll. Smith) illustrated in fig. 1 ought to be considered as the prototype of the species. It is provided with its body-chamber and is the largest of five examples which have been collected in the Tropites-limestone of Kalapani and Tera Gádh by Smith and A. von Krafft.

This specimen seems to agree very closely with *Acanthinites excelsior* E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 531, Taf. CXCIV, figs. 1, 2) in its general shape, involution and sculpture. From a comparison with the illustrations given by E. v. Mojsisovics one might even be induced to take their specific identity into consideration. But a personal examination of the two specimens of *Acanthinites excelsior* from the sevatic Hallstattlimestone of the Poetschenhoehe has convinced me of the impossibility of identifying them. It is their poor state of preservation which forbids any attempt at specific identification. The two Alpine examples illustrated by E. v. Mojsisovics are much distorted, crushed, and so unsatisfactorily preserved, that the shape of their external parts is absolutely unknown.

The strongly compressed whorls are very high, and overlap one another to the extent of three-quarters of their height. They enclose a deep and funnel-shaped umbilicus, surrounded by a perpendicular umbilical wall, which is separated from the lateral parts by a sharply-rounded umbilical edge. To this umbilical edge the greatest transverse diameter corresponds. From this point the lateral parts converge towards the external part and pass gradually into the latter without the intervention of a distinctly defined marginal edge. The siphonal area itself is narrow and excavated by a flat median depression. This external depression is bordered on either side by low keels, which are partly doubled in later stages of growth.

The sculpture of the lateral parts consists of transverse ribs and spiral rows of delicate tubercles. The transverse ribs are broad, flat and slightly falciform. They are very numerous and separated by intercostal furrows of equal width. Bifurcations of ribs occur near the umbilical margin or, less frequently, in the middle of the height of the lateral parts.

The number of spiral rows of tubercles is very large, certainly not less than 25. Where the cast is perfectly preserved, it is easy to see that the elevated spiral elevation, which crosses each rib longitudinally, consists of two delicate tubercles or spines. But these little spines are so delicate that it only needs a slight injury of the uppermost layer of the cast to destroy this character.

There are, indeed, few shells of ammonites with a more graceful and complicated ornamentation.

The most interesting feature of the present species is the sculpture of its external part. It differs from that in *Acanthinites excelsior* v. Mojsisovics (l. c. p. 530, Pl. CLIX, fig. 1) and *A. Calypso* v. Mojsisovics (l. c. p. 532, Taf. CLVII, figs. 2, 4)—in A. *excelsior* it is barely known—by the more primitive character of its external keels. The external keels bordering the median depression are not faintly serrated but adorned with external ears, as in *Cyrtopleurites*. To each rib an elongated ear and to each intercostal furrow a depression in the keel corresponds. In the last volution of my type-specimen the keels are double, the main keel being accompanied by a second thinner one. In the two above-quoted Alpine species of *Acanthinites* this development of external ears along the keels is restricted to the inner volutions, whereas in my Himálayan species it persists in later stages of growth.

In young specimens the keels are simple and consist only of rounded keel-tubercles, greatly elongated spirally, whereas the depressions corresponding to the intercostal spaces are not elevated above the general level of the siphonal part. The median furrow makes its appearance at earlier stages of growth than the external ears.

Dimensions.

Diameter of the shell		58 mm.
„ „ „ umbilicus		7 „
Height of the last volution	above the umbilical suture	29 „
	„ „ preceding whorl	24 „
Thickness of the last volution		15 „

Sutures.—The sutural line of the genus *Acanthinites* is not known in detail. E. v. Mojsisovics only remarks the dolichophyllic development of the sutures in *Acanthinites excelsior*. I have succeeded in developing the sutural line of the specimen illustrated in fig. 3. The saddles are dolichophyllic and provided with elongated leaves which are deeply notched. From *Hauerites* and *Cyrtopleurites* the sutural line of *Acanthinites* chiefly differs by the absence of distinct adventitious elements.

The siphonal lobe, which is considerably shorter than the principal lateral lobe, is divided by a broad median prominence, occupying the entire depression between the external keels. In the outer wing of this lobe a small denticle is separated from the adjoining siphonal saddle. This denticle might be considered as an equivalent to the denticles in *Cyrtopleurites*, dividing each wing of the siphonal lobe.

The siphonal saddle is pyramidal and its two marginal walls are equally serrated, no difference being noticed in the development of secondary denticles or *phylla* between the outer and inner margins as in *Cyrtopleurites*. The lobes exhibit a higher degree of denticulation than in any species of *Cyrtopleurites* or *Hauerites*. Deep and elongated digitations are especially noticed in the principal lateral lobe. Both the principal and second lateral lobe are divided into two finger-shaped points by a narrow denticle rising at their base.

The siphonal and principal lateral saddles are of nearly equal height. The second lateral saddle is considerably shorter but yet distinctly brachyphyllic. It is followed by a rounded auxiliary lobe, the position of which coincides with the umbilical margin. Along the umbilical wall a rounded auxiliary saddle and a second auxiliary lobe follow.

Remarks.—There is a distant external similarity between this species and *Sirenites Solonis* v. Mojsisovics (Cephalopoden der Hallstätter Kalke, l. c., VI-2, p. 751, Taf. CLVI, fig. 1) from the carnic Hallstatt-limestone of Aussee. *S. Solonis* holds a rather isolated position among its congeneric forms, on account of its delicate sculpture, which consists of numerous transverse folds, crossed by spiral stripes. But the absence of any bifurcations in the ribs near the siphonal margin excludes at once the possibility of a closer relationship between *Acanthinites Hogarti* and *Sirenites Solonis*.

Subgenus: *HIMAVATITES* nov. subgen.

HIMAVATITES WATSONI nov. sp. Pl. IX, figs. 1, 2.

The two figured casts belonged to the same individual. The fragment illustrated in fig. 1 forms part of the body-chamber of the mature specimen, the chambered cast fig. 2 is the inner nucleus, which I have figured separately, in order to show the development of sculpture along its external part. Besides this specimen several small and medium-sized examples have been collected in the Tropites-limestone of Tera Gádh by Smith and A. v. Krafft.

The inner nucleus is of globose shape. It is only in later stages of growth that the volutions are more strongly compressed and considerably higher than wide. They overlap one another almost completely. Thus even in the full-grown specimen a very narrow umbilicus only is left open. The umbilical wall is steep but low. The lateral parts unite with the regularly rounded siphonal area without any distinct demarcation. They are flatly arched in the inner volutions but nearly flat from the umbilical margin up to the middle of their height in the last whorl.

The sculpture of the lateral parts is very characteristic. Stronger primary ribs alternate irregularly with lower secondary costæ. Both of those are either straight or flexuous and always turned anteriorly in the marginal region. They show a rather complicated arrangement, rising either singly or in pairs from umbilical tubercles and bifurcating twice or three times at different distances from the umbilical margin.

The stout primary ribs originate near the umbilical margin, but among the secondary ribs a considerable number of those which are intercalated do not extend so far. Each of the primary ribs is adorned by two or three very stout tubercles, most of which have been broken off in the cast but have left large scars. This sort of sculpture somewhat recalls *Protrachyceras Pollux* Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 641, Taf. CLXVII, figs. 18, 19). In general the pattern of ribbing is very similar to that noticed in many *Trachyceratea*.

This sculpture is most strongly developed in adolescent stages of growth. On the body-chamber fragment of my type-specimen the difference between primary and secondary ribs weakens and the large lateral tubercles or prominences become lower and smaller.

The trachyceratitic pattern of sculpture is combined with the ordinary ornamentation of *Acanthinites*. Thirty rows of spirally elongated, delicate spines are counted between the umbilical margin and the siphonal keel. Two or even three single spines stand along each row on every single rib.

The character of the siphonal part also differs from that in typical species of *Acanthinites* by the poor development of external keels.

The smooth and rounded median furrow is distinctly marked, even at very early stages of growth, though not deeply excavated. It is bordered on either side by a very low keel, consisting of spirally elongated external ears. The close affinity of our species to *Cyrtopleurites*, the nearest ally of the genus *Acanthinites*, is clearly proved by this feature.

The external ears are strongly elongated and provided with fringed margins, as in *Cyrtopleurites* or in young individuals of *Acanthinites excelsus* Mojs. They are of irregular length, those corresponding to primary ribs being longer.

Dimensions.

Diameter of the shell		32 mm.
„ umbilicus		2 „
Height of the last volution	above the umbilical suture	20 „
	„ „ preceding whorl	14 „
Thickness of the last volution		16 „

Sutures.—Not known.

Remarks.—This is a very interesting species on account of the presence of characters which recall *Acanthinites*, *Sagenites* (*Trachysagenites*) and *Protrachyceras*, three genera which, in the general system of ammonites, stand widely apart.

If we compare *Acanthinites excelsus*, the prototype of the genus, with our species, we are bound to confess that in its general shape and involution the latter exhibits a closer similarity with some species of *Sagenites* than with *Acanthinites*. It is especially the group of *Sagenites erinaceus* and *S. hystrix* (subgenus *Trachysagenites* Gemmellaro) that the habit of the Himálayan form strongly recalls.

In the sculpture of *A. Watsoni* we find besides a considerable approach to some types of *Protrachyceras*, especially to *P. Pollux* Mojs., distinguished by transverse ribs of alternating strength and by stout spines. The combination of stout and coarse tubercles with the ordinary ornamentation of *Acanthinites*, consisting of spiral rows of delicate spines, is a feature of peculiar interest.

Notwithstanding its external resemblance to *Trachysagenites* and *Protrachyceras*, the present species must necessarily find its systematic position among the nearest allies of *Cyrtopleurites*. This is proved by the character of its siphonal area. The two external keels, though poorly developed, clearly show their origin from external ears, agreeing with the ears in *Cyrtopleurites*. The presence of such keels accompanying a median furrow absolutely forbids this species to be classed among the representatives of *Sagenites*. As its systematic position must be looked for among the relatives of *Cyrtopleurites*, the genus *Acanthinites* appears to be best suited for its accommodation.

The characters, which distinguish *A. Watsoni* from the prototype of the genus, *Acanthinites excelsus*, Mojs., namely, the globose shell, the poor development of the median furrow and keels, and the presence of ribs of alternating strength, occasionally set with coarse tubercles, might in the eyes of the majority of palæontologists appear to be of subgeneric importance.

If this view should be accepted, the subgeneric name of *Himavatites* is proposed for *Acanthinites Watsoni*.

Genus: POLYCYCLUS Mojsisovics.

POLYCYCLUS HENSELI Oppel. Pl. VII, fig. 12.

1865. *Ammonites Henseli* Oppel., Palæontologische Mitteilungen aus dem Museum des Königl. bayr. Staates, p. 182, Taf. 41, fig. 3.

1866. *Ammonites Henseli* A. v. Dittmar, Zur. Fauna der Hallstätter Kalke, Geognost. Palæont. Beitræge von Benecke, Schloenbach und Waagen, p. 357, Taf. XIV, figs. 16—20.

1893. *Polycyclus Henseli* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 536, Taf. CXXXII, figs. 7—23.

This species, one of the commonest of the Alpine horizon of *Tropites subbullatus*, is represented in A. v. Krafft's collection from Kalapani by a specimen, which agrees perfectly and in every respect with the description and figures given by A. v. Dittmar and E. v. Mojsisovics. My comparison of this specimen with Alpine examples has convinced me of their specific identity.

Although provided with its body-chamber, my Himálayan specimen is of very small size only. Its shell consists of volutions, which increase more slowly than in the typical forms of *P. Henseli*, but more rapidly than in the *varietas directa*. In this respect and also in the character of its ornamentation it agrees best with the *varietas intermedia* of E. v. Mojsisovics. The cross-section is almost rectangular with rounded-off margins. There is no distinctly-developed umbilical edge present.

The ribs originate either singly or in pairs at the umbilical suture and cross the rounded siphonal area without any interruption. Occasionally they become slightly thickened at the margins or on the siphonal area. They are sharp, narrow and separated by angular intercostal furrows, which are of equal width along the siphonal and umbilical margins. Most of the ribs are not exactly radial but strongly directed forward and nearly straight.

Dimensions.

Diameter of the shell	12·5 mm.
,, ,, ,, umbilicus	3·5 ,,
Height of the last volution	5 ,,
Thickness of the last volution	4 ,,

Sutures.—The sutural line, as far as accessible to examination, is almost exactly identical with that of the specimen from the *Subbullatus*-beds of the Vorder Sandling, illustrated by E. v. Mojsisovics in fig. 13 (Pl. CXXXII).

The siphonal lobe is short, rounded at its base, and divided by a very low median prominence. In the apparently goniatitic outlines of the principal lateral lobe indistinct indentations may be seen by means of a magnifying glass. The second lateral lobe is very small and goniatitic. There are no auxiliary lobes present. The second lateral saddle is the innermost sutural element outside the umbilical suture.

Genus : CLIONITES Mojsisovics.

1. CLIONITES GRACILIS, nov. sp. Pl. VI, fig. 5; Pl. VII, fig. 13.

This species holds a rather isolated position among the genus, on account of its strongly involute whorls and its narrow umbilicus. I do not know of any Alpine species of *Clionites* with which in this respect it might be advantageously compared.

The volutions are strongly compressed and overlap one another to the extent of two-thirds of their height. The high-mouthed transverse section is nearly rectangular. The lateral parts are flat and marked off by well-defined margins from the siphonal area, which they meet at right angles. The umbilical margin is not distinctly defined, but the flanks slope in a steep curve towards the umbilical suture. The umbilicus is very narrow. This peculiar character makes the distinction of the present species from all congeneric forms an easy matter.

In its sculpture *Clionites gracilis* recalls *Cl. Valentini* Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 474, Taf. CLIII, fig. 1) and *Cl. Dorae* Mojsisovics (l. c., p. 474, Taf. CXLIII, fig. 4) from the carnic Hallstatt-limestone of Aussee.

The inner volutions, of which but very little is exposed within the narrow umbilicus, are covered with numerous and delicate transverse ribs. The sculpture of the last whorl consists of equally numerous and narrow falciform ribs, which run in a tolerably straight direction from the umbilical margin up to the middle of the flanks and then describe flatly arched segments, with their convexity turned backwards, on the upper portion of the lateral parts. The primary ribs originate as single ribs or in pairs near the umbilical margin, where they are raised into radially protracted tubercular prominences, which are, however, not regularly distributed throughout the entire last volution. The number of primary ribs is slightly surpassed by that of secondary ones, which are formed chiefly by intercalation.

The external furrow is not excavated but marked only by a row of external rounded tubercles on either side. A second row of faintly developed tubercles corresponds to the siphonal margin. Between the external and marginal tubercles the ribs are directed obliquely forward. The sculpture is completely interrupted along the external furrow.

Dimensions.

Diameter of the shell	21	mm.
" " " umbilicus	4	"
Height of the last volution { above the umbilical suture	10	"
" " preceding whorl	7·5	"
Thickness of the last volution	5·5	"

Sutures.—Not known in detail, but exhibiting the normal number of ceratitic lobes. Lobes provided with deep indentations, saddles entire. There is at least one auxiliary lobe standing outside the umbilical suture. Siphonal and principal lateral saddles of equal height.

Locality.—Number of specimens examined.—Tera Gádh 2, coll. Krafft; Kalapani 1, coll. Krafft.

2. CLIONITES sp. ind. aff. CL. HUGHESII Mojs. Pl. VII, fig. 9.

The fragment figured, from the Tropites-limestone of Tera Gádh (coll. Smith), consisting of a portion of the body-chamber and a few remnants of the penultimate whorl, is closely related to *Clionites Hughesii* Mojsisovics (Palæontologia Indica, ser. XV, Himálayan Foss., Vol. III, pt. 1, p. 64, Pl. XIV, figs. 1—3) from the Halorites-limestone of the Bambanag section.

They agree almost perfectly in their general shape and involution. The slowly increasing whorls are somewhat higher than broad and embrace one another on the siphonal part only. The sculpture shows the same elements as *Cl. Hughesii*, transverse ribs and rows of spiral tubercles. But the ribs are thin and delicate, not as stout as in *Cl. Hughesii.* They stand close together and are separated by intercostal depressions twice or three times as wide as the narrow ribs. The ribs are either simple or bifurcate in umbilical tubercles. Intercalated secondary ribs also occur frequently. There are three rows of spiral tubercles developed: an umbilical, a marginal and an external one. This is also the number of rows in the body-chamber of *Clionites Hughesii*, the third row of lateral tubercles, which is developed on the inner volutions of this species, disappearing completely in the body-chamber of full-grown individuals. The external and marginal tubercles are of equal strength and disposed regularly. To every rib a marginal and external tubercle correspond, whereas the umbilical tubercles are weaker and occur at irregular distances.

From *Clionites Hughesii* the present species must be separated on account of its more delicate ribbing.

Dimensions.—Not measurable.

Sutures—Not known.

3. CLIONITES sp. ind aff. C. ABERRANS Mojs. Pl. VII, fig. 11.

This species is closely related to *Clionites aberrans* v. Mojsisovics (Palæont. Ind., ser. XV, Himálayan Foss., Vol. III, Pt. 1, p. 63, Pl. XIII, fig. 8) from the Halorites-limestone of the Bambanag range and differs from it only by subordinate details in its shape and ornamentation. The only specimen available for examination is, unfortunately, incomplete. It was collected in the Tropites-limestone of Kalapani by the late A. v. Krafft.

My specimen is more strongly involute than any of the species from the Halorites-limestone. The whorls embrace one another to the extent of one-half their height. The umbilicus is consequently narrower than in *Cl. aberrans.* Otherwise the two species agree in shape. It is chiefly the body-chamber whorl which exhibits a striking similarity in its most important characters to *Protrachyceras Thous* Dittm., as has been remarked by E. v. Mojsisovics.

The sculpture of the body-chamber consists of falciform ribs, which are often divided into two or three narrow and thread-like folds. They are more strongly elevated in the vicinity of the umbilical and siphonal margins, where they are adorned with tubercles. But the row of umbilical tubercles is rather weak and the tubercles are disposed irregularly. The external tubercles are produced spirally, though not as strongly as in *Cl. aberrans.* There is no row of tubercles indicated between the external and marginal tubercles. In the vicinity of the aperture all three rows of tubercles become visibly weaker. The sculpture is not interrupted completely by the external furrow, but some of the transverse ribs meet even this low and gradually-disappearing furrow.

The ornamentation of the penultimate whorl differs more remarkably from that of *Clionites aberrans.* It consists of numerous falciform ribs, which originate from stout umbilical tubercles, and is more delicate than in the species from the Halorites beds. Traces of lateral tubercles are indicated, besides the external and marginal rows. The sculpture of the partly exposed siphonal region of this volution justifies the present species being placed among the representatives of the genus *Clionites*, notwithstanding its external resemblance to *Protrachyceras*.

Dimensions.

Diameter of the shell	37·5	mm.
" " " umbilicus	9	"
Height of the last volution { above the umbilical suture	16	"
" " preceding whorl	18	"
Thickness of the last volution	11	"

Sutures.—Not known in detail.

Remarks.—As features of distinction between this species and the nearly allied *Clionites aberrans* the following may be enumerated: the smaller umbilicus, the delicate and falciform character of the ribs in the inner volutions, the absence of rounded, keel-like tubercles on the siphonal part of the body-chamber.

Mention must be made here of the remarkable similarity which this species shows with some representatives of the genus *Mojsisovicsites* Gemmellaro (I cefalopodi del trias superiore della regione occidentale della Sicilia, p. 57), especially with *M. crassecostatus* Gemmellaro (l. c. p. 59, Pl. XXVIII, figs. 5—9, 14, 15). *Mojsisovicsites* is also characterised by a change in the sculpture, distinguishing the inner volutions from the body-chamber whorl. The inner whorls of *M. crassecostatus* exhibit falciform ribs originating in strong umbilical tubercles, and a spiral row of marginal and lateral spines. On the last volution the three rows of tubercles gradually disappear, and the falciform lateral ribs are reduced to delicate folds or striæ. In their involution my Himálayan and the Sicilian species agree perfectly. Gemmellaro hinted at a possible affinity of his new genus to *Anatibelites*, but I think that a still closer relationship with *Clionites* might be taken into consideration.

4. Clionites Stauntoni nov. sp. Pl. VII, fig. 8.

This type is represented by seven tolerably well preserved examples from the Tropites-limestone of Tera Gádh (coll. Smith), all of them of small dimensions and provided with their body-chambers. It is more nearly allied to the Indian representatives of the genus from the Halorites-limestone, than to any of the European forms. It might be most advantageously compared to *Clionites Salteri* v. Mojsisovics (Palæont. Indica, ser. XV, Himál. Foss., Vol. III, Pt. 1, p. 62, Pl. XIII, figs. 6, 7).

The slowly-increasing whorls are of equal height and width and embrace one another on the external part only. The greatest diameter of the transverse section corresponds to the rounded-off umbilical margin. From this place the flanks converge very gradually towards the external margins, where they pass into the inflated siphonal part in a regularly-rounded curve.

The sculpture consists of strong transverse ribs running in a tolerably straight direction to the siphonal margin and are then turned obliquely forwards. They are separated by wide intercostal spaces. In the vicinity of the aperture the ribs become more numerous and delicate. On the inner volutions they are very stout. They are either simple or bifurcate at the umbilical margin. The point of bifurcation is marked by a strong umbilical tubercle. With the development of delicate and narrow ribs on the body-chamber the row of umbilical tubercle gradually disappears.

The most conspicuous elements of sculpture are the strong external tubercles, greatly produced spirally at their base. They considerably surpass in size the pointed marginal spines, in which occasional bifurcations of ribs also occur. The external furrow is not excavated in the shell but is formed by the rows of external tubercles bordering it on either side.

No traces of lateral tubercles have been noticed.

Dimensions.

Diameter of the shell	23	mm.
" " " umbilicus	8·5	"
Height } of the last volution	9	"
Thickness } of the last volution	8·5	"

Sutures.—Agreeing in their general arrangement with those of *Clionites Salteri.* Only two large saddles with entire margins. The second lateral lobe standing inside the umbilical margin. Siphonal and principal lateral lobes strongly serrated.

5. Clionites sp. ind. aff. Cl. Dolloanus Mojs. Pl. VII, fig. 10.

This fossil from the Tropites-limestone of Kalapani (coll. Krafft), somewhat distorted by pressure and obliquely drawn out, belongs to all appearance to a species of the group of *Clionites Dolloanus* v. Mojsisovics, (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 468, Taf. CXXIX, fig. 1) from the carnic stage of the Hallstatt-limestone.

Notwithstanding its small size the specimen seems to possess the body-chamber. The whorls slowly increase, are less numerous, and overlap one another to a larger extent than in *Cl. Dolloanus*. They are somewhat higher than broad and vaulted regularly, without umbilical or marginal edges.

The innermost volutions are not accessible to examination. The penultimate whorl is covered with numerous and delicate radial ribs. In the last volutions the ribs become falciform but less strongly so than in *Cl. Dolloanus*. They are separated by wide intercostal spaces. Bifurcations or intercalations of ribs only occur exceptionally and not outside the apertural margin of the shell. Marginal tubercles are faintly developed on the body-chamber.

The affinity with *Cl. Dolloanus* is chiefly marked by the great similarity in the ornamentation of the siphonal area. The sculpture is interrupted along the median line of the external part, but a true furrow is not developed before the aperture has been reached. Along this median line the ribs arriving from either side correspond exactly in their direction and are elevated into distinct, rounded tubercles.

Dimensions.

Diameter of the shell	17·5 mm.
„ „ „ umbilicus	5·5 „
Height } of the last volution	7 „
Thickness } of the last volution	5 „

utures.—Not known.

Family : *TIROLITIDÆ.*

Section : TRACHYCERATEA.

Genus : TRACHYCERAS Laube.

TRACHYCERAS nov. sp. ind. Mojsisovics.

1896. *Trachyceras nov. f. ind.*—E. v. Mojsisovics, Denkschr. Kais. Akad. d. Wiss. LXIII. p. 647, Taf. XI, fig. 9.

1899. *Trachyceras nov. f. ind.*—E. v. Mojsisovics, Palæont. Indica, ser. XV, Himálayan Foss. Vol. III, Pt. 1., p. 90, Pl. XI, fig. 9.

Of this species only a single, imperfectly preserved cast has been found in the Tropites-limestone of Kalapani by A. v. Krafft. It does not add anything to our very limited knowledge of the species, which is based on a fragment discovered at the same locality by C. L Griesbach. Even the reference to the genus *Trachyceras* has not been established with full certainty, the external parts in both fragments being missing.

No illustration of this specimen has been given, on account of its defective state of preservation.

Subgenus: *PROTRACHYCERAS* Mojsisovics.

1. PROTRACHYCERAS ANSONI nov. sp. Pl. XI, figs. 3, 5.

Two specimens from the Tropites-limestone of Kalapani (coll. Krafft) belong to a rather isolated form of the subgenus *Protrachyceras*. They are characterised by their concentrated involution and small size. Both specimens seem to be provided with their body-chambers.

The widely-expanding shell possesses a very narrow umbilicus, the volutions embracing one another almost entirely. The transverse section is strongly compressed, nearly twice as high as broad, with flatly-vaulted lateral parts and a flattened siphonal area.

The sculpture shows the characteristic habit of *Protrachyceras*. The ribs are falciform, separated by wide intercostal spaces, and strongly elevated. They are the predominant element in the ornamentation. The tubercles are of small size. Besides the row of external tubercles there are at least five rows of spiral tubercles developed, but two among them are but very faintly marked. The external row of tubercles, bordering the deeply excavated and narrow median furrow, is the most conspicuous.

Among the Alpine species of *Protrachyceras* there is none to which the present form might advantageously be compared.

Dimensions.

Diameter of the shell	25	mm.
" " " umbilicus	1·5	"
Height } of the last volution	14·5	"
Thickness } of the last volution	8	"

Sutures.—Not known.

2. PROTRACHYCERAS sp. ind. Pl. XI, fig. 4.

This undeterminable fragment from the Tropites-limestone of Tera Gádh, probably representing a new species, recalls in its general habit the group of *Trachycerata margaritosa*, especially *Trachyceras Aon* Muenst. and its allies. Its sculpture consists of very numerous and closely-set ribs, which frequently bifurcate in the middle of the height of the lateral parts and are adorned with seven spiral rows of tubercles. But in contrast to true *Trachycerata* the external row of tubercles is not double. Nor is there any probability that this feature in the present specimen is only dependent on its stage of growth. To this opinion I am led by the fact, that the external tubercles are scarcely more strongly developed than those of some lateral rows. The species must consequently be classed under the subgenus *Protrachyceras*

Dimensions.—Not measurable.

Sutures.—Not known. The fragment seems to belong to the body-chamber notwithstanding its small dimensions.

Genus : SANDLINGITES Mojsisovics.

1. SANDLINGITES PEARSONI nov. sp. Pl. VI, fig. 4.

The present species shows some resemblance to the European *Sandlingites Reyeri* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 713, Taf. CLXVII, fig. 3) from which it is distinguished by its high, strongly involute whorls and its narrow umbilicus. There is, indeed, no other species so narrowly umbilicated among this genus.

The strongly compressed volutions embrace one another to the extent of five-sixths of their entire height. The cross-section is twice as high as broad and bordered by very flatly arched lateral parts. Towards the umbilical suture the flanks slope in an uninterrupted curve, which increases very gradually in steepness. Thus no distinct umbilical margin or wall is developed. The external margin is better marked, corresponding to a bluntly rounded edge.

The sculpture consists of falciform ribs, which from the umbilical towards the marginal region considerably increase in number either by bifurcation or by intercalation. Near the external margin the ribs are much more crowded and separated by narrower intercostal spaces than on the lower part of the flanks. The ribs are sharp and in adolescent stages of growth elevated into radially protracted prominences in the vicinity of the umbilicus. But on the body-chamber of the last volution the sculpture is gradually obliterated in the umbilical region, and the umbilical prominences disappear completely.

The sculpture is interrupted along the middle of the external part. No proper median furrow is developed, but only a smooth median band between the external tubercles, marking the terminations of the lateral ribs. In young stages of growth the siphonal margin is also marked by a spiral row of feeble, spine-like tubercles, which gradually disappear on the body-chamber. Near the aperture the ribs begin to close together from both sides along the median band, but the bridges connecting the external tubercles, which do not decrease in strength at the same time, are but very faintly indicated.

Dimensions.

Diameter of the shell		36	mm.
„ „ „ umbilicus		6	„
Height of the last volution	above the umbilical suture	18	„
	„ „ preceding whorl	12 5	„
Thickness of the last volution		10	„

Sutures.—Not known.

Locality.—Number of specimens examined.—Lilinthi 1, coll. Smith ; Kalapani 2, coll. Krafft, 1, coll. Smith.

Remarks.—Among the Himálayan materials there is a fragment from Kalapani which probably represents a species very nearly allied to the present one, differing from it only by a wider umbilicus. I shall not give a detailed description of this specimen, on account of its fragmentary state of preservation.

2. SANDLINGITES TUCKERI nov. sp. Pl. VI, fig. 6.

This species is distinguished from the preceding form by more slowly increasing and less involute whorls, by a wider umbilicus and by coarser ribs. It is also nearly allied to the Alpine *Sandlingites Reyeri* Mojsisovics, from which it differs chiefly by the absence of a distinct umbilical margin and wall.

The volutions are considerably higher than broad and overlap one another to the extent of a little less than one-half their height. The lateral parts are flatly arched and bend flatly and with continually increasing convexity down to the umbilical suture. No marked umbilical margin exists, nor is the umbilicus deep and scale-like as in *Sandlingites Reyeri.*

The lateral ribs are numerous, coarse and perfectly straight in the inner volutions and in the posterior portion of the last whorl. They are, as a rule, dichotomous and adorned with external and marginal tubercles. In the lower part of the flanks the stem-ribs are often strongly elevated above the general level. In the anterior portion of the last whorl the ribs become slightly falciform, their concavity being turned forward in the marginal region. At the same time they are more crowded and delicate. The marginal tubercles decrease in strength but the external spines remain unaltered.

The smooth median band, which interrupts the lateral sculpture, is crossed by faintly marked and low ribs in the vicinity of the aperture. This pattern of ornamentation especially recalls the sculpture in *S. Reyeri.*

Dimensions.

Diameter of the shell	37 mm.
„ umbilicus	13 „
Height of the last volution. above the umbilical suture	15 „
„ „ preceding whorl	12 „
Thickness of the last volution	10·5 „

Sutures.—Not known.

Locality.—Number of specimens examined.—Lilinthi 1, coll. Smith; Tera Gádh 3, coll. Smith.

3. SANDLINGITES cf. ORIBASUS v. Dittmar. Pl. VI, fig. 7.

1866. *Ammonites Oribasus* A. v. Dittmar, zur Fauna der Hallstätter Kalke, Geognost. palæont. Beitræge von Benecke Schloenbach und Waagen, Bd. I., p. 384, Taf. XVIII, figs. 8—10.

1893. *Sandlingites Oribasus* v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abandl. K. K. Geol. Reichsanst., VI-2, p. 706, Fab. Taf. CLXVII, figs. 5-7.

My Himálayan specimen from the Tropites-limestone of Tera Gádh differs from *Sandlingites Oribasus* Dittm., from the carnic Subbullatus beds of the

Salzkammergut, only by its larger dimensions. Among the three specimens illustrated by E. v. Mojsisovics it agrees best with the example fig. 6.

The volutions overlap one another to the extent of one-half their height, leaving a moderately wide umbilicus open. The sculpture consists of falciform ribs and three rows of spines. In the external and marginal rows a distinctly developed spine corresponds to every rib. In the umbilical row the spines or tubercles are more irregularly distributed. A minority of ribs only is distinguished by stronger development, but these are always primary ribs, which, as a rule, originate in pairs from an umbilical tubercle. The umbilical tubercles exceed the external and marginal ones in size.

Intercalated secondary ribs are rather frequent. Near the beginning of the last volution the ribs are as densely crowded as in the Alpine specimen of *S. Oribasus*. In the vicinity of the aperture the ribs are less numerous and separated by wider intercostal spaces.

The marginal and external tubercles persist throughout the entire length of the last volution. E. v. Mojsisovics noticed in his Alpine specimen, illustrated in fig. 7, a gradual obliteration of those two rows of spines near the anterior termination of the body-chamber whorl, but my personal examination of his specimen has convinced me that this apparent obliteration is only accidental, the siphonal part having been slightly injured in the vicinity of the aperture.

The primary ribs originating from umbilical tubercles are elevated above the general level along the lower portion of the flanks, but beyond the middle of the height of the lateral parts do not surpass the intercalated ribs in strength.

There is no smooth median band on the siphonal area between the external spines, but the ribs close together from both sides.

Dimensions.

Diameter of the shell	25	mm.
„ „ „ umbilicus	6	„
Height of the last volution above the umbilical suture	11	„
„ „ „ preceding whorl	8·5	„
Thickness of the last volution	7	„

Sutures.—Very simple, but not clydonitic. The two lateral lobes provided with a few short indentations at their base. The siphonal lobe is not accessible to observation. Saddles entire. A rounded auxiliary lobe is divided by the umbilical suture.

4. SANDLINGITES sp. ind. ex. aff. ARCHIBALDI Mojs. Pl. V, fig. 9.

The specimen figured from the Tropites-limestone of Kalapani (coll. Smith) belongs to all appearance to a species very closely allied to *Sandlingites Archibaldi* E. v. Mojsisovics (Palæont. Indica, ser. XV, Him. Foss. Vol. III, Pt. 1, p. 92, Pl. XVII, figs. 1, 3—5) from the Halorites-limestone of the Bambanag range.

As there is only a single, much injured cast available for examination, nothing definite can be said about the possibility of its being identical with the species from the Halorites beds. I believe, however, that we have to deal here with a new species, which seems to be distinguished from *S. Archibaldi* by the presence of a more strongly developed sculpture in the inner volutions. As far as can be made out from the bad preservation of the penultimate whorl, it appears to be covered with straight and sharp transverse ribs, rising into stout umbilical and marginal tubercles.

The last volution closely agrees in its sculpture with *S. Archibaldi*, showing numerous and sharp falciform ribs, which often bifurcate. The marginal and external spines are distinctly marked throughout the entire length of the shell. The ornamentation is weaker, but not entirely interrupted along the median band between the external tubercles.

In size my specimen closely agrees with the example illustrated in fig. 5 by E. v. Mojsisovics, but its transverse section is less strongly compressed and its whorl are somewhat more involute. The spiral of involution touches the marginal spines of the penultimate whorl.

Dimensions.

Diameter of the shell	19	mm.
" " " umbilicus	6	"
Height of the last volution	7·5	"
Thickness of the last volution	7	"

Sutures.—Not known in detail.

Genus: SIRENITES Mojsisovics.

Every palæontologist, who has had to deal with Triassic ammonites belonging to this genus, will agree with me in my opinion that safe specific determinations of specimens are only possible with perfectly preserved examples available for examination. In the Himálayan collection of A. v. Krafft and Smith the genus *Sirenites* is rather richly represented, but a large number of specimens is unfit for determination, on account of their incomplete state of preservation. Most of the species fit for a proper description, are closely allied to, or even identical with, European forms. They belong to the groups of *Sirenites senticosi, S. striatofalcati, S. Pamphagus* and *S. Argonautæ*.

A. Group of *Sirenites senticosi*.

1. SIRENITES TRACHYCERATOIDES nov. sp. Pl. IX, fig. 4.

This species is represented by two large specimens from Tera Gádh (coll. Smith) which, though not complete, are sufficiently well preserved to permit of a satisfactory diagnosis of their distinguishing features. The figured type-specimen is provided with its entire body-chamber and with a part of the mouth margin.

Sirenites trachyceratoides differs from the rest of the species belonging to the group of *S. senticosi* by its concentrated involution. The umbilicus is very narrow, narrower even than in *S. Hortensiæ* Mojs. or in *S. Theresiæ* Mojs. which otherwise show a distant affinity to our Himálayan form.

The shell reaches considerable dimensions. The volutions embrace one another almost entirely and are higher than broad. The siphonal area is provided with a deep median excavation, which is bordered on either side by a row of external spines. The siphonal part passes gradually into the flanks, without intervention of any distinct demarcation. The umbilical margin is steeply rounded. There is no edge developed between the lateral parts and the high, perpendicular umbilical wall. The greatest transverse diameter is situated above the umbilical margin within the lower portion of the lateral parts.

The predominating element in the ornamentation of the cast are the strong and sharp ribs which, originating at the umbilical margin run in a straight line, radially, to the middle of the height of the sides, but in the upper portion of the flanks describe flat curves with their convexity turned forward. Primary ribs and short intercalated ribs, which are limited to the marginal region, alternate fairly regularly. Most of the ribs of both kinds bifurcate in the siphonal region, but some remain undivided. This character recalls the genus *Trachyceras*.

Tubercles or spines are less strongly developed than the ribs. They are most conspicuous along a spiral row accompanying the row of marginal tubercles in which the bifurcation of the ribs takes place. Between this row and the umbilical margin three more spiral rows of spines have been noticed. The innermost row is situated a little below the middle of the height of the lateral parts. The umbilical region is also absolutely free from tubercles. The external spines form a continuous row of edges, which rise obliquely above the general level of the siphonal part. A proper "pig-tailed" keel, however, as in many European species of the group, is not developed.

In the vicinity of the aperture of the last volution the shell has been partly preserved. Besides the broad and sharp stem-ribs, numerous thin and thread-like ribs are noticed, which increase in number towards the marginal region and follow the direction of the stem-ribs.

Near the aperture the body-chamber is slightly inflated and tube-shaped. The peristome, as far as preserved, runs parallel to the direction of the ribs and on the external part is protracted anteriorly into a short lappet.

Dimensions.

Diameter of the shell		cca.	120	mm
„ „ „ umbilicus			11	„
Height of the last volution	above the umbilical suture		71	„
	„ „ preceding whorl		40	„
Thickness of the last volution			44	„
Transverse diameter of the peristome			53	„

Sutures.—Not known.

B. Group of *Sirenites striatofalcati.*

2. SIRENITES sp. ind. ex. aff. S. KOHANYI Mojs. Pl. X, fig. 2.

The figured fragment from Tera Gádh (coll. Smith), somewhat distorted by pressure, belongs to a species which is very nearly allied to *Sirenites*

Kohanyi v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst VI, p. 746, Taf. CLXII, figs. 21—23) from the triassic Hallstatt-limestone of Aussee of middle carnic age.

The last volution is very narrow and strongly compressed. Its largest transverse diameter is 135 mm. its height 35 mm. measured along the partly broken-off aperture. Its lateral parts are gently and regularly arched and converge towards the narrow siphonal area, which consists of two crenulated external edges, enclosing a deeply excavated median depression. The umbilical region is very poorly preserved.

The sculpture, consisting of flat, falciform ribs, agrees almost exactly with that of *Sirenites Kohanyi*. The only subordinate details in which the two species differ, are the somewhat wider intercostal spaces and the character of the external crenulation in the Himálayan form. In the latter a sharp edge is formed bordering the siphonal furrow, whereas in *S. Kohanyi* similar sharp edges are only developed in adolescent stages of growth, but are replaced by broader, "pig-tailed" keels in the last volution.

Apart from these no other features of distinction have been noticed.

Dimensions.—Not measurable.

Sutures.—Not known.

C. Group of *Sirenites Pamphagus* Dittm.

8. SIRENITES PAMPHAGUS Dittmar. Pl. X, figs. 8, 9.

1866. *Ammonites Pamphagus* A. v. Dittmar, zur Fauna der Hallstätter Kalke, Benecke's Geognost. Palæont. Beitræge I Bd., p. 372, Taf. XVI, figs. 20—22.

1893. *Sirenites Pamphagus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke Abhandl. K. K. Geol. Reichsanst., VI-2, p. 761, Taf. CLX, figs. 4—8.

1904. *Sirenites Pamphagus* Gemmellaro, I cefalopodi del Trias superiore della regione occidentale della Sicilia, p. 67, Pl. XXIX, fig. 20.

Three specimens from the Tropites-limestone of Kalapani (coll. Smith) admit in their shape and ornamentation of a close comparison with *Sirenites Pamphagus* from the Subbullatus beds of the Hallstatt-limestone. The specimen illustrated in fig. 9 may especially, according to my opinion, be safely identified with the European species. It only needs a comparison with fig. 7 on pl. CLX of the monograph of E. v. Mojsisovics to show the perfect agreement of the two examples in all their characters. I need scarcely mention that it was only after a careful examination of the Alpine type-specimen that I considered the specific identity of the Indian and European forms established.

A special description of this specimen is hardly necessary, as I could only repeat the diagnosis given by A. v. Dittmar and completed by E. v. Mojsisovics. It will be sufficient to note some of its individual characters.

The row of marginal tubercles is distinctly developed at the beginning of the last volution but dies out gradually in the vicinity of the aperture. The lateral tubercles are united into an elevated spiral band. The entire surface is covered with very numerous and delicate spiral lines, some of them slightly exceeding the rest in strength. The median depression in the external part is deeply excavated and bordered by crenulated "pig-tailed" keels.

Dimensions.—The measurements of this specimen are almost absolutely identical with those of the Hallstatt type.

Diameter of the shell	33 mm.
,, ,, ,, umbilicus	4·5 ,,
Height of the last volution	18 ,,
Thickness of the last volution	9 ,,

Sutures.—Not known.

The second specimen, illustrated in fig. 8, is of small size and the correctness of its identification with *Sirenites Pamphagus* is questionable. In its ornamentation it is true, it agrees very well with equal-sized examples of the Alpine species. The external tubercles are not yet united into a continuous "pig-tailed" keel, but are well individualised. Marginal and umbilical tubercles are distinctly developed, whereas the spiral row of lateral tubercles is faintly marked, but the sharp geniculation of the lateral ribs corresponding to this spiral row is clearly exhibited.

A difference between this specimen and European examples of *S. Pamphagus* of equal dimensions is the proportion of height to thickness in the transverse section. In young individuals of *S. Pamphagus* the volutions are more globose, whereas they are strongly compressed in my Indian specimen. In the shape of its transverse section the latter is more similar to *S. Agriodus* v. Dittmar, but is distinguished from it by its coarser ribbing.

Its measurements are as follows:—

Diameter of the shell	22·5 mm.
,, ,, ,, umbilicus	2·5 ,,
Height of the last volution above the umbilical suture	12 ,,
Height of the last volution ,, ,, preceding whorl	8·5 ,,
Thickness of the last volution	5·5 ,,

In my third specimen the lateral tubercles are as strongly developed as the external and marginal ones, but the lateral ribs in the region between this spiral and the umbilical margin are very faintly marked. This difference in the strength of ornamentation in the lower and upper portions of the flanks is a character of distinction between that specimen and the European *Sirenites Pamphagus.*

With the exception of the specimen illustrated in fig. 9, the examples from Kalapani should therefore be referred to *Sirenites Pamphagus* only as *cf.*

4. SIRENITES AGRIODUS v. Dittmar. Pl. IX, fig. 6.

1866. *Ammonites Agriodus* A. v. Dittmar, Zur Fauna der Hallstätter Kalke, Benecke's Geognost. Palæont. Beitræge, I. Bd., p. 373, Taf. XVI, figs. 23—25.

1893 *Sirenites Agriodus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 769, Taf. CLX, figs. 9—14.

The present Indian specimen from the Tropites-limestone of Kalapani (coll. Krafft) is an individual of large dimensions, provided with its body-chamber. The shape and ornamentation agree entirely with that of the shell in large-sized examples of *Sirenites Agriodus* Dittm. from the Subbullatus beds of the Hallstatt-limestone. There is the closest agreement with the full-grown specimen of the European type illustrated by E. v. Mojsisovics in Pl. CLX, fig. 14.

The volutions are very strongly compressed and bordered by flatly vaulted lateral parts. The umbilical edge is well defined and sharply rounded. The deep umbilicus is surrounded by a high and perpendicular wall. Towards the aperture of the last volution the umbilical suture leaves the normal spiral, but the egression is not considerable.

The ornamentation is very delicate. The lateral parts are covered with very numerous falciform ribs and spiral striæ. The spiral band corresponding to the row of lateral tubercles in young individuals is only a little more distinctly marked than the rest of the spiral striations. The marginal tubercles persist throughout the entire length of the last volution, whereas the umbilical ones grow very faint and are obliterated in the vicinity of the aperture. The deep and narrow median excavation is bordered by delicately serrated external keels.

Dimensions.

Diameter of the shell		44 mm.
„ „ „ umbilicus		5 „
Height of the last volution	above the umbilical suture	24 „
	„ „ preceding whorl	17 „
Thickness of the last volution		9·5 „

Sutures.—Not known in detail. Lobes and saddles apparently brachyphyllic.

D. Group of *Sirenites Argonautæ*.

5. SIRENITES cf. ARGONAUTÆ Mojsisovics. Pl. IX, fig. 8.

1870. *Trachyceras Argonautæ* E. v. Mojsisovics, Beitræge Zur Kenntniss der Cephalopodenfauna der oenischen Gruppe, Jahrb. K. K. Geol. Reichsanst., p. 107, Taf. V, fig. 1.

1893. *Sirenites Argonautæ* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke. Abhandl. K. K. Geol. Reichsanst., VI-2, p. 765, Taf. CLVI, fig. 2.

The type-specimen of *Sirenites Argonautæ* illustrated by E. v. Mojsisovics from the Alpine Poetschenkalk of upper noric (sevatic) age is a cast of very large size and provided with its body-chamber. My Himálayan example from the Tropites-limestone of Tera Gádh (coll. Smith) is a small individual and entirely chambered. The difficulty of identifying specimens of such different dimensions induces me to refer my Himálayan specimen to *S. Argonautæ* only as *cf.*, notwithstanding the close agreement of their involution and sculpture.

My specimen is high-mouthed, strongly involute and narrowly umbilicated. The umbilicus is deep and funnel-shaped. In the transverse section there is no complete agreement with the Alpine type-specimen. In the latter the flanks are perfectly flat and barely converge from the umbilical towards the external margin. In my Indian shell the greatest transverse diameter coincides with the umbilical region and is situated a short distance above the umbilical margin. From this point the lateral parts converge distinctly towards the siphonal area. But this difference is not essential and results from the different stages of growth of the two examples, the lateral parts being always vaulted in young individuals of *Sirenites* and turning flat only in later stages of development.

The complicated sculpture is exactly of the same pattern as in *Sirenites Argonautæ.* The ribs are separated by wide intercostal spaces, straight in the lower region of the flanks, and slightly falciform in the upper. Intercalated ribs occur frequently but not regularly.

The first distinctly marked spiral row of tubercles corresponds to the terminations of the lower, straight portion of the ribs. Between this row and the spiral row of external tubercles five lateral and marginal rows are developed, exactly as in the European *S. Argonautæ.* The two marginal rows are situated very close to each other. The bifurcation of the ribs in the siphonal region of the shell takes place at the inner row of marginal tubercles. The external tubercles are produced obliquely to the direction of the deep median furrow.

Dimensions.

Diameter of the shell	41 mm.
„ umbilicus	4 „
Height of the last volution { above the umbilical suture	23 „
Height of the last volution { „ „ preceding whorl	14 „
Thickness of the last volution	15 „

Sutures.—Not known.

6. SIRENITES sp. ind. ex. aff. S. ARGONAUTÆ Mojs. Pl. IX, fig. 7.

An incomplete fragment from the Tropites-limestone of Tera Gádh (coll. Krafft) consists of one-half a volution apparently belonging to the body-chamber. In its size and involution it agrees perfectly with the type-specimen of *S. Argonautæ* v. Mojsisovics but differs from it in the following characters.

The transverse section is more strongly compressed, a transverse diameter of 20 mm. corresponding to a height of 47 mm. near the aperture of the volution. The ribs are more numerous and separated by intercostal spaces of equal width. There is no external row of marginal tubercles outside the spiral row, in which the bifurcation of external ribs occurs. The straight portion of the ribs in the lower region of the flanks is less strongly developed, but adorned with two spiral rows of distinctly marked spines.

In the number of ribs and in the presence of nine distinctly marked rows of tubercles this fragment agrees with the specimen from the Poetschenkalk, which has been described and illustrated as *Sirénites sp. ind. ex aff. S. Argonautæ* by E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 766, Taf. CLVI, fig. 7). To this Alpine species it is certainly most nearly allied. The only difference consists in the irregular arrangement of simple and bifurcating ribs in the Indian form, whereas in the European species all the ribs bifurcate regularly in the middle of the height of the lateral parts.

Dimensions.—Not measurable.

Sutures.—Not known.

7. SIRENITES ARGONAUTÆFORMIS nov. sp. Pl. X, fig. 1.

This species is represented in the Himálayan collection by a single, incomplete but well preserved specimen from the Tropites-limestone of Tera Gádh (coll. Smith). It is very nearly allied to *Sirenites Argonautæ* Mojs., but in some of its characters also approaches *S. Dianæ* v Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 767, Taf. CLVI, figs. 4, 6).

The volutions are moderately thick, though considerably higher than broad. The greatest transverse diameter is situated above the regularly rounded off umbilical margin. The lateral parts are flatly arched and converge gradually towards the broadly vaulted siphonal part. The umbilicus is very small. From the rounded umbilical margin the umbilical wall slopes down to the umbilical suture in a steeply bent curve. Thus in its shape and involution the present species strongly recalls *S. Dianæ*.

In the ornamentation of the shell the affinities to *S. Dianæ* are less close than to *S. Argonautæ*. The number of ribs is larger than in those two European species. Another feature of distinction is the irregular alternation of stronger and weaker ribs. The ribs of the first class are always primary ribs or stem-ribs, which originate near the umbilical margin. The majority of weaker ribs are intercalated. Ribs of both classes frequently bifurcate in the vicinity of the third spiral row of lateral tubercles. This third spiral row consists of stout, coarse tubercles which are, however, not developed on every rib. The spines of the two next inner rows following in the direction of the umbilicus are less strongly marked. Outside the third row two more lateral rows of spines and two marginal rows follow.

The marginal rows stand very closely to each other. It is the outer, not the inner row, in which the bifurcation of external ribs is noticed. In this character the present species recalls *Sirenites Dianæ*, whereas in the other details of ornamentation it is more similar to *S. Argonautæ*. The two spiral rows of marginal tubercles are more strongly developed than the lateral rows, especially so in the vicinity of the aperture. The external tubercles are smaller, but produced obliquely to the direction of the deep but narrow median furrow.

The marginal tubercles are circular at their base. The tubercles of the two

following lateral rows are spirally elongated. The number of marginal tubercles is exactly one-half the number of external ones.

Dimensions.

Diameter of the shell	55	mm.
„ „ „ umbilicus	4	„
Height of the last volution { above the umbilical suture	32	„
„ „ preceding whorl	20	„
Thickness of the last volution	25	„

Sutures.—Not known.

8. SIRENITES cf. DIANÆ Mojsisovics. Pl. X, fig. 3.

1893. *Sirenites Dianæ* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 767, Taf. CLVI, figs. 4, 6.

Among three specimens from Tera Gádh (coll. Smith) the figured example is almost complete and provided with its body-chamber, to which three-quarters of the last volution belong. Its direct identity with *Sirenites Dianæ* from the noric Hallstatt-limestone of the Sommeraukogel is doubtful, on account of some insignificant differences in subordinate details. It is for this reason that I have referred it to that European species only as *cf.* It is certainly related to it most closely.

In its shape and involution the figured specimen agrees with *Sirenites Dianæ*, but its transverse section is more high-mouthed, the proportion of height to width in the aperture being 30 : 17 (44 : 29 in *S. Dianæ*). The siphonal area is sharply rounded and provided with a deeply excavated, angular median furrow. The umbilical margin is rounded but forms a distinct demarcation between the lateral parts and the steep umbilical wall. E. v. Mojsisovics describes the latter as "sloping gently down to the umbilical suture." But this is not the case in his type-specimen from Hallstatt, which has a high and perpendicular umbilical wall in the last volution, as is also clearly seen from his illustration in fig. 4*b*.

The surface is covered with falciform, flat and broad ribs, separated by narrow intercostal spaces. This pattern of ornamentation imparts to the shell an aspect very different from *S. Argonautæ* and its allies. It is this pattern of sculpture which characterises *Sirenites Dianæ* and *S. Euphrosynæ* Mojs.

Most of the sigmoidal ribs are dichotomous. Bifurcation or intercalation of lateral ribs occurs only in the middle of the height of the flanks. The bifurcation of the external ribs occurs in spirally elongated marginal tubercles. Frequently two elongated prominences follow each other very closely, but the outer marginal spiral is not complete and is faintly developed. The number of external tubercles is more than twice as great as that of marginal ones. The external tubercles stand very close to each other and are interrupted by narrow breaches, thus forming a sort of crenulated "pig-tailed" keel, which borders the median furrow on either side.

There are six rows of lateral tubercles, as in the variety of *Sirenites Dianæ* illustrated in fig. 6 by E. von Mojsisovics. The two innermost spiral rows are less distinctly developed than the third row. In the marginal and topmost lateral rows the tubercles are spirally elongated, whereas their base is circular in the other rows.

Dimensions.

Diameter of the shell	55 mm.
" " " umbilicus	5 "
Height of the last volution { above the umbilical suture	30 "
Height of the last volution { " " preceding whorl	20 "
Thickness of the last volution	17 "

Sutures.—As far as known to me, very similar to those of *S. Achillis* v. Mojsisovics (l. c., p. 768, Taf. CLVI, fig. 3*c*). Siphonal lobe not entirely accessible to examination, but shorter than the principal lateral lobe, which is provided with deep digitations at its base. Principal saddles pyramidal and dolichophyllic. Second lateral saddle low and brachyphyllic and followed by a long umbilical lobe, the small denticulations of which represent rudimentary auxiliary lobes and saddles.

Remarks.—As to this specimen, one might, on account of its outward similarity to *Sirenites Dianæ* and *S. Euphrosynæ* v. Mojsisovics (l. c., p. 768, Taf. CLVI, fig. 5), be in doubt to which of those two very closely allied species it ought to be referred. I have given the preference to a provisional identification with *S. Dianæ*, notwithstanding the more compressed shape of its transverse section, because my Indian specimen has the two inner rows of lateral tubercles less distinctly developed than the third row, whereas these two rows are very strongly marked in *S. Euphrosynæ*. The rounded character of the majority of the lateral tubercles, in the specimen here described, is also a feature in which it agrees better with *S. Dianæ* than with *S. Euphrosynæ*.

9. SIRENITES EVÆ Mojsisovics. Pl. IX, fig. 5.

1893. *Sirenites Evæ* v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 769, Taf. CLVI, figs. 8, 9.

The figured specimen, by which this species is represented in the Himálayan collection from the Tropites-limestone of Tera Gádh, does not deviate in the slightest degree from the type-specimen of *Sirenites Evæ*, which has been described and illustrated by E. v. Mojsisovics. The absolute agreement of the two equally-sized specimens justifies their direct identification, on which I should perhaps not have ventured without a personal examination of the Hallstatt type, the details of its complicated ornamentation having not been reproduced satisfactorily in the illustration on Pl. CLVI, fig. 8*a* of E. v. Mojsisovics' memoir.

It is especially the more prominent character of the sickle-shaped portion of the lateral ribs in the marginal region, which is clearly marked in the Indian and European shells, but is not shown to its full extent in the illustration quoted above. The two marginal rows of tubercles are obliquely elongated in the direction of the ribs and stand so closely together that their character of tubercles is lost, and the marginal portions of the ribs are, as a whole, raised above their general level.

There are altogether seven spiral rows of tubercles besides the external ones which are united into crenulated "pig-tailed" keels.

Dimensions.

Diameter of the shell		31 mm.
„ „ „ umbilicus		2·5 „
Height of the last volution	above the umbilical suture	18 „
	„ „ preceding whorl	14 „
Thickness of the last volution		9·5 „

The dimensions of the Indian and European specimens are absolutely identical. In the description given by E. v. Mojsisovics the length of the diameter is indicated as 37 mm., but this is a mistake, as can be seen from a glance at his illustration.

Sutures.—The sutures of the Alpine type-specimen from the white Hallstatt-limestone of the Leisling of lower noric age were not known to E. v. Mojsisovics. In my Indian shell the sutural line is distinctly marked, the specimen consisting of air-chambers only. It is similar to that of *Sirenites elegans* v. Mojsisovics from the Halorites-limestone of the Bambanag range.

The siphonal lobe is narrower than in *S. elegans*, but its details are not accessible to observation. The lateral lobes terminate in deep digitations. The siphonal saddle surpasses the principal lateral saddle considerably in height. It is bipartite, an accessory branch being developed on its external margin. Its dolichophyllic development has not yet reached the leptophyllic stage as in *S elegans.*

The second lateral saddle is small and brachyphyllic. It is united with the following auxiliary series into a sort of umbilical lobe, the elements of which appear as narrow denticles only.

Remarks.—With *Sirenites Richteri* v. Mojsisovics (Palaeont. Indica, ser. XV, Himál. Foss., Vol. III, Pt. 1, p. 94, Pl. XVII, fig. 10) from the Halorites limestone of the Bambanag range—a species very closely allied to *S. Evæ*—my specimen from Tera Gádh cannot be identified on account of its more numerous and delicate ribs and of the smaller number of spiral rows of tubercles.

10. SIRENITES ALIXIS nov. sp. Pl. X, fig. 5.

This species is represented in Smith's collections from the Tropites-limestone of Tera Gádh by an almost complete specimen of large size, the surface of which, however, has been partly injured by weathering.

In its general shape, dimensions and involution, it closely agrees with *Sirenites Stachei* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 770, Taf. CLVII, fig. 8). The high-mouthed, strongly compressed and narrowly umbilicated shell possesses moderately curved lateral parts. The greatest transverse diameter is situated below the middle of the height of the flanks. From this spot the lateral parts slope gently and regularly towards the siphonal part and umbilical margin. The siphonal part is formed by two low and crenulated "pig-tailed" keels, enclosing the narrow median furrow. The umbilical margin is rounded and separated from the umbilical suture by a low but steep wall.

This species is chiefly distinguished by the remarkable change its ornamentation undergoes in the last volution. At the beginning of the latter the ornamentation strongly recalls *Sirenites elegans* Mojsisovics (Palæontologia Indica ser. XV, Himál. Foss., Vol. III, Pt. 1, p. 93, Pl. XVII, figs. 8, 9), from the Halorites-limestone of the Bambanag range, consisting, as it does, of numerous and delicate sigmoidal ribs and a large number of spiral rows of tubercles. There is, however, one remarkable difference between the sculpture of *S. elegans* and *S. Alixis*. In *Sirenites elegans* "the ribs have on the flanks a strong concavity towards the anterior, succeeded by a not inconsiderable backward curvature on the outer part of the sides." This backward-turned curvature in the marginal parts of the ribs, which is especially conspicuous in the fragment illustrated in fig. 9 by E. v. Mojsisovics, is absent in *S. Alixis*, which in the shape of the ribs agrees more closely with *S. Evæ* Mojs.

More than one-half of the last volution belongs to the body-chamber. Here the sigmoidal ribs become less close and thinner, whereas the width of the corresponding intercostal spaces increases. Near the aperture the ribs are replaced by thin and thread-like striæ, which are adorned by small, circular tubercles. The marginal parts of the ribs, which in the chambered portion of the shell are prominent and elevated above the general level, are gradually weakened in strength. Of ten or eleven spiral rows of tubercles, which are counted at the posterior termination of the last whorl, not more than five persist throughout the entire length of this volution.

The change in the ornamentation of the shell in the last volution is very remarkable and unparalleled by any of the congeneric species. Whereas the chambered portion nearly approaches *Sirenites Evæ* or *S. elegans*, the body-chamber part recalls *S. Vredenburgi*, which is distinguished by the presence of very delicate, thread-like, falciform ribs throughout the entire length of its last volution.

Dimensions.

Diameter of the shell		90 mm.
" " " umbilicus		5 "
Height of the last volution	above the umbilical suture	49 "
	" " preceding whorl	31 "
Thickness of the last volution		23 "

Sutures.—I have not succeeded in developing the entire sutural line of the present specimen, but its most interesting part, namely, the external one, has been laid bare.

The siphonal lobe is short, considerably shorter than the principal lateral lobe and moderately broad. It is provided with a low and narrow median prominence and is divided in each of its halves into two points by a small denticle, exactly as in *S. elegans*.

The principal lateral lobe is the deepest. It is provided with elongated indentations and terminates in two digitations of equal length. The most interesting element of the sutural line is the siphonal saddle, whose denticulation has reached the dolichophyllic stage. The outer branch, which in *S. elgans* is separated from the main mass of the saddle by a deeply penetrating secondary lobe, is still more strongly individualised and assumes the character of a true adventitious saddle. The stems of the adventitious and of the true siphonal saddles are pyramidal but less slender and with a broader base than in *S. elegans*.

Beyond the inner margin of the principal lateral lobe nothing of the sutural line is known to me.

11. SIRENITES VREDENBURGI nov. sp. Pl. IX, fig. 9.

This species represents an isolated type of *Sirenites*, being distinguished from the congeneric forms by its very delicate ornamentation, the ribs being thin and thread-like and adorned with small, transversely elongated tubercles.

The specimen figured from the Tropites limestone of Kalapani (coll. Krafft) is a full-grown individual, provided with its body-chamber. It is very strongly compressed, high-mouthed and possesses a very narrow umbilicus, which is bordered by a low umbilical wall. The lateral parts are very gently and regularly arched. The narrow siphonal part is bordered by two external keels, which are crenulated and pig-tailed (plaited) and enclose a low median furrow.

The lateral parts are smooth at the beginning of the last volution. On the body chamber the flanks exhibit very low and delicate falciform folds, separated by wide intercostal spaces. Each fold bears from eight to ten delicate tubercles, which are produced radially in the direction of the ribs. These tubercles consequently do not assume the character of a longitudinal or spiral element of sculpture as in the majority of congeneric species.

The marginal row of tubercles has the appearance of a low, plaited band of prominences, as in *Sirenites Stachei* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 770, Taf. CLVII, fig. 8).

Dimensions.

Diameter of the shell	70	mm.
„ „ „ umbilicus	2·5	„
Height of the last volution. above the umbilical suture	62·5	„
„ „ preceding whorl	23	„
Thickness of the last volution	13	„

Sutures.—Not known.

12. SIRENITES sp. ind. ex aff. VREDENBURGI Dien. Pl. X, fig. 4.

The figured fragment of a body-chamber from Lilinthi (coll. Krafft) shows a great resemblance in shape and sculpture to *Sirenites Vredenburgi* and points to a species closely related to it.

The transverse section was, probably, less strongly compressed, though the fragmentary state of the specimen does not allow exact measurements. The siphonal area is considerably broader and the umbilicus somewhat wider than in *S. Vredenburgi.*

There are six spiral rows of lateral tubercles and a double row of marginal tubercles present. The external marginal tubercles stand outside the spiral of bifurcation of the external ribs. They are produced longitudinally, whereas all the other tubercles are elongated in the direction of the very delicate and thread-like sigmoidal ribs.

The crenulated, "pig-tailed" external keels are broad, but very low.

Dimensions.—Not measurable.

Sutures.—Not known.

Subgenus: *ANASIRENITES* Mojsisovics.

1. ANASIRENITES cf. MENELAUS v. Mojsisovics. Pl. X, fig. 10.

1893 *Anasirenites Menelaus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 779, Taf. CL, fig. 6.

A fragment from the Tropites-limestone of Kalapani (coll. Smith) is referable to this European species from the Subbullatus beds of the Salzkammergut. On account of the fragmentary character of the specimen it is not possible to venture on a direct identification.

The shape, size and sculpture agree in all essential points apparently with *Anasirenites Menelaus.* This is one of the most conspicuous species of the subgenus and is easily distinguished from all the rest of the congeneric forms by the absence of marginal and external tubercles, which are replaced by longitudinal keels. This feature is clearly seen in my fragment, which is provided with sharp external keels and marginal edges.

The lateral parts are very flatly vaulted and separated from the highly rounded siphonal part by steep marginal edges. The narrow umbilicus is surrounded by a high and steep wall.

The sculpture is but very faintly developed. At first glance the lateral parts appear to be smooth. It is only after a careful examination that numerous and delicate, falciform striæ are noticed on the cast of the posterior portion of the fragment. The anterior part of the last volution has been injured by weathering and does not show any trace of ornamentation.

Dimensions.—Not measurable.

Sutures.—Not known.

2. ANASIRENITES GREENI nov. sp. Pl. X, fig. 7.

In the Himálayan collection this species is represented by a single but nearly complete specimen from the Tropites-limestone of Kalapani (coll. Smith). It may be compared with *Anasirenites Briseis* v. Mojsisovics (Die Cephalopoden der Halstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-2, p. 776, Taf. CLX, fig. 15) and *A. Aristotelis* v. Mojsisovics (l. c., p. 780, Taf. CLXII, fig. 1) but must be referred to a new species on account of differences in its sculpture and sutures.

The specimen is provided with its body-chamber, to which more than one-half of the last volution belongs.

The volutions are high-mouthed, very strongly compressed and increase rather rapidly in height. The largest transverse diameter is situated below the middle of their height. The lateral parts are flatly arched and converge gradually towards the narrow siphonal area. The median furrow is deeply excavated and bordered by high and sharp external keels. The keels are faintly crenulated at the beginning of the last volution but become perfectly smooth in later stages of growth. Marginal edges or spiral bands are entirely absent.

The umbilicus is deep and surrounded by a steep wall, which is separated from the flanks by a flatly rounded umbilical margin.

The ornamentation of the shell is characterised by the absence of tubercles. In the middle of the flanks a continuous spiral band may be considered as an equivalent of lateral tubercles in *Anasirenites Briseis.* Besides this slightly elevated spiral band, numerous but very delicate spiral lines have been noticed, especially in the lower region of the lateral parts, where the transverse ribs are more faintly marked.

The principal elements of sculpture are numerous, sigmoidal ribs, which originate in pairs or even in bundles near the umbilical margin. They run straight as far as the lateral spiral band in the middle of the flanks but describe a very flat curve in the upper portion of the shell with its concavity turned forward. In the meantime they increase considerably in strength and width, exactly as in *A. Aristotelis* v. Mojsisovics from the noric Hallstatt-limestone of the Sommeraukogel. The chief difference in the sculpture of those two species is the greater number and the much more delicate character of the ribs in the Himálayan form, especially in the lower region of the shell.

In the vicinity of the aperture a large number of transverse ribs are obliterated completely in the lower portion of the flanks. The few remaining ribs are separated by wide intercostal spaces, as in the specimen of *S. Agriodus* Dittmar illustrated by E. v. Mojsisovics on Pl. CLX, fig. 14, of his monograph.

In the regular distribution of the sigmoidal ribs along the upper portion of the flanks no interruption has been noticed.

Dimensions.

Diameter of the shell	66	mm.
„ „ „ umbilicus	6·5	„
Height of the last volution { above the umbilical suture	37	„
Height of the last volution { „ „ preceding whorl	29	„
Thickness of the last volution	12·5	„

Sutures.—The sutural line shows a remarkable similarity to that of *Sirenites Achillis* v. Mojsisovics (l. c., Pl. CLVI, fig. 3*c*). It differs from that o

Anasirenites Aristotelis by the absence of a large secondary branch in the external margin of the siphonal saddle. The principal lateral lobe is the deepest.

Lobes provided with elongated digitations. Main saddles broad, pyramidal and dolichophyllic. Second lateral saddle brachyphyllic and united with the auxiliary series into a long suspensive lobe.

Section: DISTICHITEA.

Genus: DISTICHITES Mojsisovics.

The genus *Distichites* is rather richly represented in the fauna of the Tropites-limestone of Byans. As in the fauna of the Alpine Hallstatt beds two groups may be distinguished, the groups of *Distichites megacanthi* and of *Distichites compressi*. To the first group strongly sculptured species with wide umbilici belong, whereas in the second delicately ornamented types with narrow umbilici predominate.

Of eleven species altogether not less than seven belong to the group of *D. megacanthi*. This is even a larger number of species than has hitherto been made known from the upper Trias of the Eastern Alps.

A. Group of *Distichites Megacanthi*.

1. DISTICHITES nov. sp. ind. aff. MEGACANTHI Mojs. Pl. I, fig. 3.

The figured fragment of a body-chamber is partly distorted by compression and its inner volutions have been entirely destroyed. But the sculpture has been sufficiently well preserved to allow the close affinities of the present species to *Distichites megacanthus* v. Mojsisovics (Cephalopoden der Hallstäter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 598, Taf. CXLVI, fig. 4) to be recognised with full certainty.

The shape of the outer volution of this fragment points to a species with very slowly increasing whorls and with a widely opened umbilicus. It is impossible to state to what extent the volutions originally overlapped each other.

The cross-section is strongly compressed, especially so near the anterior end of the body-chamber. The diameter of the umbilicus must have surpassed the height of the last volution considerably. In both these characters our species differs from *Distichites megacanthus*.

The lateral parts are flat and pass very gradually and regularly into the rounded siphonal area, but are separated from the steep and comparatively high umbilical wall by a distinctly marked edge. This edge is ornamented with numerous but irregularly arranged spines, which do not follow each other at equal distances. Especially near the anterior end of the fragment they are set more closely and at the same time slightly diminish in strength. From these umbilical spines flat and broad ribs originate, which in the vicinity of the marginal region are raised into large tubercles. These marginal tubercles are the most remarkable element of sculpture.

The majority of the flat ribs connecting the umbilical and marginal tubercles are not simple but divided into two or three ribs, which run parallel but are again united by the big marginal tubercles, which play the part of parabolic ears in other Triassic genera, for instance in *Sibirites* or in *Ceratites geminati*. Occasionally even two ribs, originating from two distinct umbilical spines, are fused into one single marginal tubercle.

The arrangement of the marginal tubercles is not so regular as in *D. megacanthus*. Sometimes there is a tubercle of smaller size intercalated between two large ones, which are disposed at a greater distance from each other than the rest. All the marginal tubercles are connected by a spiral band, which in some places is accompanied by subordinate spiral lines.

Outside this spiral band the strongly vaulted siphonal part is covered with numerous strong ribs which are directed obliquely forward towards the siphonal keel-furrows. The external ribs originating from the marginal tubercles are, as a rule, stronger and broader than the intratubercular ribs, and are frequently divided into two parallel costæ. The majority of the intratubercular ribs is not continued beyond the spiral band, which connects the marginal tubercles. This pattern of sculpture strongly resembles the ornamentation of *Distichites megacanthus*.

The external ribs meet the edge of the keel-furrows at a very small angle. The keel-furrows are accompanied by two keels bordering a deeply excavated median depression, with a regularly rounded base. The keels are high and sharp, not low and broad as in *D. megacanthus*.

Dimensions.

Diameter of the shell		126 mm.
„ „ „ umbilicus		50 „
Height	of the last volution	45 „
Thickness		27 „

Sutures.—The sutures of this species are not known to me, no fragment of the chambered inner volutions having been preserved.

Remarks.—Although this species is but imperfectly known, its close resemblance to *Distichites megacanthus* from the lacic (lower noric) limestone of the Sommeraukogel near Hallstatt is obvious. There is another fragment of *Distichites* from Tera Gádh in the Indian collection, which points to a second species, perhaps still more nearly allied to *D. megacanthus*. But it is a fragment not suitable for illustration and too unsatisfactorily preserved to admit of a more decided opinion as to its agreement with, or deviation from, the European type.

The specimen here described was collected by F. H. Smith in the Tropites-limestone of Lilinthi.

2. Distichites Sollasii nov. sp. Pl. I, fig. 1.

This species is represented in Smith's collection from Tera Gádh by a small number of specimens provided both with chambered inner volutions and body-chambers. The type-specimen is a well-preserved cast, with fragments of the shelly substance adhering to the siphonal part.

In its general shape and involution this species exhibits a great resemblance to *Distichites megacanthus* Mojsisovics (l. c., p. 598, Taf. CXLVI, fig. 4). Its volutions increase more rapidly than in the preceding species from the Tropites-limestone of Lilinthi. Its lateral parts are more regularly rounded and its umbilicus is a little less widely opened. The external keels are broadly rounded, low and smooth. The median depression is considerably deeper than the two keel-furrows, which are but indistinctly developed.

The most important character of this species is the remarkable variation, which its sculpture undergoes on the body-chamber of full-grown individuals.

The morphological agreement of the inner volutions with *Distichites megacanthus* or *D. celticus* is extraordinarily great. The lateral parts of the inner whorls are covered with strong, straight ribs connecting the umbilical tubercles and marginal spines. The marginal spines are well developed and adpressed to the high, perpendicular wall of the following whorl, being arranged exactly along the spiral of involution. The only distinguishing feature between young individuals of this species and *D. megacanthus* or *D. celticus* of equal size is the character of the lateral ribs, which are not simple but divided into two parallel costæ.

Near the beginning of the body-chamber the sculpture undergoes a very remarkable variation. The umbilical tubercles continue for some distance, but diminish in strength and are disposed rather irregularly. The marginal tubercles disappear completely and are replaced by produced elevations of the lateral ribs, which become more densely crowded and sharp, recalling the ornamentation which is so frequently met with in Indian representatives of the group of *Ceratite circumplicati*. Thus the remarkable difference between the ribs along both sides of the marginal spiral band in *D. megacanthus* and *D. celticus* is entirely absent, nearly all the ribs, which originate near the siphonal keel-furrows, being continued across the lateral parts of the shell as far as the umbilical edge.

In the development of falciform ribs on the body-chamber the species approaches *D. Harpalos* v. Dittmar. In the group of *Distichites compressi* such falciform ribs are a very common pattern of sculpture.

Dimensions.

Diameter of the shell	110 mm.
„ „ umbilicus	40 „
Height of the last volution { above the umbilical suture	32 „
„ „ preceding whorl	41 „
Thickness of the last volution	29 „

Sutures.—Among the European representatives of the group of *Distichites megacanthi* there is only one species, *Distichites Atropus* v. Dittmar, the sutures of which have been figured by E. v. Mojsisovics (l. c. Taf. CXLVI, fig. 3*c*). It is a very small species and its brachiphyllic sutural line exhibits but a slight resemblance to that of the present form.

For a closer comparison the sutural lines of several species of the group of *Distichites compressi* must be taken into consideration. Among them *Distichites Loidli* v. Mojsisovics (l. c. Taf. CXLIX, fig. 2) very nearly approaches *D. Sollasii* as regards its sutures.

The siphonal lobe is shorter than the principal lateral lobe, and is divided by a high and broad median prominence, reaching across the two external keels and keel-furrows. This median prominence shows a triphyllic termination, the broader central lappet being bordered by two outer *phylla*, corresponding to the external keels. This is exactly the character of the siphonal prominence, as it has been illustrated in *Distichites Wulfeni* (l. c. Taf. CLI, fig. 1*c*) by E. v. Mojsisovics. But in all the rest of the characters the sutural line of our species differs from that of *D. Wulfeni* and agrees in general with the sutures of *D. Loidli*.

Each wing of the siphonal lobe and the principal lateral lobe are divided at their base into two diverging points. The second lateral lobe is shorter than the siphonal lobe and not bipartite. The saddles are less slender than in *Distichites Loidli*, but provided with dolichophyllic branches. The siphonal saddle is considerably higher than the principal lateral saddle. The second lateral saddle is low and probably bipartite.

I have not succeeded in examining the auxiliary series, which must, however, consist of very few and small elements only, since the second lateral saddle touches the umbilical edge.

3. Distichites Falconeri nov. sp. Pl. I, fig. 2.

Of this species one single specimen only from the Tropites-limestone of Tera Gádh (coll. Smith) is available for examination. It consists of the inner volutions, which have been almost entirely preserved, and of a fragment of the body-chamber, which, although imperfect, permits a satisfactory reconstruction of the complete specimen.

In its general shape and involution the present species resembles *Distichites Minos* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 602, Taf. CXLVII, fig. 5), but is distinguished from it as well as from all the rest of the congeneric species of the group of *D. megacanthi* by its very strongly developed sculpture, which persists in the full-grown individual.

The sculpture of the inner volutions recalls that exhibited by *Distichites celticus* Mojsisovics (l. c., p. 600, Taf. CXLVII, figs. 1, 2). There are, however, several differences in the details of their ornamentation. The number of umbilical and marginal tubercles is equal in the Alpine species, whereas, in the present form sixteen marginal and eleven umbilical tubercles are counted in the penultimate whorl. Besides the stout umbilical and marginal tubercles, which are of equal strength, a third row of indistinctly developed spines is noticed between the marginal spirals and the keel-furrows.

The keels are high and sharp and accompanied by distinct keel-furrows. From these keel-furrows ribs originate, which are directed obliquely backward towards the marginal tubercles. As a rule, one pair of ribs is united in one marginal tubercle, but a small number of ribs remain simple. No intercalated ribs cross the intertubercular spaces without touching a marginal tubercle. Thus the number of ribs beyond the marginal spiral never reaches twice the number of lateral ribs.

The umbilical tubercles persist in later stages of growth. They even increase in size on the body-chamber, although they diminish in number. The marginal tubercles become obliterated. The lateral sculpture consists of strong and broad falciform ribs, which frequently dichotomise, especially so in the vicinity of the siphonal margin.

Dimensions.

Diameter of the shell		53 mm
„ „ umbilicus		17 „
Height of the last volution	above the umbilical suture	27 „
	„ „ preceding whorl	20 „
Thickness of the last volution		21 „

Sutures.—Not known in detail but probably similar to those of *Distichites Atropus* Mojsisovics (l. c. Taf. CXLVI, fig. 3*c*). A high and slender siphonal saddle with brachyphyllic incisions has been noticed.

The development of very strong, falciform ribs and the absence of marginal tubercles in later stages of growth impart to this species its peculiar character, and distinguish it from the congeneric forms of the Alpine Trias.

4. DISTICHITES sp. ind. aff. D. CELTICO Mojsisovics. Pl. I. fig. 4.

In this species is included a number of small and globose representatives of the genus from the Tropites beds of Tera Gádh (coll. Smith). The species is perhaps also present at Kalapani (coll. Krafft). The figured specimen, tolerably completely preserved, may be taken as prototype. Notwithstanding its small dimensions it is provided with its body-chamber, to which at least one-half of the last volution belongs.

The specimen shows a close resemblance to *Distichites celticus* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., V-2, p. 600, Taf. CXLVII, fig. 1) both in general shape and sculpture. It is distinguished especially by its more globose shell and by its more broadly vaulted siphonal area. The most striking element of sculpture consists in the high marginal spines. These spines, of which sixteen are counted in the last volution, were probably composed of solid shelly substance. In places where the spines have been broken off, their bases are formed by a smooth surface, not by an irregularly ractured cicatrice. This fact fully agrees with similar observations made by E. v. Mojsisovics on the spines of *Thetidites Huxleyi* (Palæontologia Indica, ser. XV, Himál. Foss., Vol. III, Pt. I, p. 32).

The transverse ribs connecting the marginal and umbilical tubercles are never simple, but consist regularly of two bifurcating ribs, closing at the spines from which they originate. This character of the transverse ribs, which also recalls *Thetidites Huxleyi*, is a remarkable feature of distinction between the present species and *Distichites celticus*, from the lower noric Hallstatt-limestone of the Sommeraukogel and of Hallein. From each of the marginal spines two diverging ribs run across the siphonal part to the keel-furrows. Intercalated ribs, which are exceptionally noticed, do not reach the spiral of marginal spines.

The keels are sharp and very narrow, the median depression between surpassing them in width considerably.

Dimensions.

Diameter of the shell	44 mm.
„ „ „ umbilicus	15 „
Height of the last volution { above the umbilical suture	17 „
„ „ „ { „ „ preceding whorl	12 „
Thickness of the last volution	22 „

Sutures.—Not known.

Remarks.—Full-grown individuals of this species closely resemble young specimens of *Distichites Falconeri*. They only differ in very subordinate details, the transverse section of *D. Falconeri* being less broad, the siphonal part being more strongly vaulted and the external ribs bearing traces of tubercles. But whereas in *D. Falconeri* the ornamentation changes abruptly in the adult stage, the present species is distinguished by the persistence of adolescent characters in late stages of growth.

The difference of sculpture in adult and in young individuals is very considerable in *Distichites Falconeri*, but insignificant in the species under description.

5. DISTICHITES sp. ind. aff. D. ATROPUS v. Dittm. Pl. I, fig. 6.

The only specimen available for examination is a well preserved cast of a small form provided with its body-chamber, from the Tropites-limestone of Tera Gádh (coll. Smith).

The species agrees with *Distichites Atropus* v. Dittmar (Zur Fauna der Hallstätter Kalke, in Geognost. Palæont. Beitræge von Benecke, Schlœnbach und Waagen, Bd. I, 1866, p. 363, Taf. XV, figs. 13—15) in the shape of its flattened siphonal area and in its broadly trapezoidal transverse section.

The greatest transverse diameter corresponds to the marginal tubercles. The volutions embrace each other but very little, the last whorl enveloping the siphonal area of the penultimate whorl only and leaving its marginal spines visible within the umbilicus. A distinctly developed umbilical margin is confined to the last volution. In the inner whorls the lateral parts slope obliquely towards the umbilical suture, without any well defined demarcation. Marginal spines have been noticed in earlier stages of growth than umbilical ones, but in the last volution those two elements of sculpture are of equal strength.

E. v. Mojsisovics noticed the polygonal character of the spiral of involution in the inner whorls of *Distichites Atropus.* This feature is not exhibited in my example, but its innermost whorls are not sufficiently well preserved to allow an accurate study of their details.

The umbilical and marginal spines are connected by lateral ribs, bifurcating in the marginal tubercles and reaching across the siphonal area to the low keel-furrows. The keels are high and sharp and therefore differ considerably from the low, barely elevated keels in *D. Atropus*, as illustrated by E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 602, Taf. CXLVI, fig. 3).

A closer comparison of this species with *Distichites Atropus* is rendered difficult by the great difference in their dimensions. The only specimen of the Alpine species hitherto known, from the noric marble of Goisern, is of small size and its ornamentation is consequently less strongly developed than in my example, whose inner whorls have been partly damaged. Nevertheless there can be scarcely any doubt about their close relationship, regarding the remarkable agreement in the shape of their transverse sections.

Dimensions.

Diameter of the shell	33	mm.
„ „ „ umbilicus	12	„
Height of the last volution. above the umbilical suture	11·5	„
„ „ preceding whorl	10·5	„
Thickness of the last volution	15	„

Sutures.—Not known.

6. DISTICHITES cf. HARPALOS v. Dittmar. Pl. I, fig. 5.

1866. *Ammonites Harpalos* A. v. Dittmar, Zur Fauna der Hallstatter Kalke, Geognost. Palœont. Beitræge von Benecke, Schlœnbach und Waagen, Bd. I, p. 383, Taf. XVIII, figs. 6, 7.

1893. *Distichites Harpalos* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 599, Taf. CXLVII, figs. 3. 4, 6.

The specimen figured from the Tropites-limestone of Lilinthi (coll. Smith) is partly distorted and of elliptical outline. It cannot be decided whether this elliptical outline is an accidental deformity. If the elliptically oblique shape were considered as a deformity through pressure, not as a specific character, there would be no reason for separating the present species from *Distichites Harpalos*, from the noric Hallstatt-limestone of the Salzkammergut.

In its dimensions the present specimen holds an intermediate position between A. v. Dittmar's type-specimen and the larger example illustrated in fig. 4 by E. v. Mojsisovics. I have not succeeded in discovering any traces of sutures, and I am, consequently, unable to say whether this specimen, notwithstanding its small size, was provided with its body-chamber or not.

The inner whorls are partly in an unfavourable condition of preservation, but enough of them is exposed to show the small difference in the character of their sculpture and of the ornamentation of the last volution. The lateral parts are flat in their lower portions, but from the marginal or lateral tubercles are gradually curved towards the median depression, which is bordered by two sharp and smooth keels, marked off distinctly from the main portion of the shell.

The ornamentation consists of numerous ribs, which bifurcate regularly in the marginal tubercles. They connect the umbilical and marginal tubercles in a straight line and become curved and turned forward, when passing across the highly rounded siphonal part. They are far more numerous than in *Distichites celticus* v. Mojsisovics.

Dimensions.

Diameter of the shell	34·5	mm.
" " " umbilicus	11	
Maximum height } of the last volution	15	
" width } of the last volution	12	
Minimum height } of the last volution	10	
" width } of the last volution	11·5	
Corresponding diameter } of the shell	24	"
Corresponding diameter } " " umbilicus	7	"

Sutures.—Not known.

Remarks.—With the exception only of the elliptical outline, I could not detect any characters in which this specimen differs from *Distichites Harpalos*. If its elliptical shape is only accidental, I regard it as identical with the Alpine form.

Distichites Harpalos is quoted by E. v. Mojsisovics from the red marble of the Sommeraukogel near Hallstatt and from the Duerrenberg near Hallein. Both localities have yielded a rich fauna of middle noric age.

7. DISTICHITES sp. ind. aff. D. MINOS. v. Mojsisovics.

A fragment from the Tropites-limestone of Nihal not suitable for illustration must be mentioned here on account of its remarkable similarity to *Distichites Minos* v. Mojsisovics (Die Cephalopoden der Hallstaetter Kalke, Abhandl. K.K. Geol. Reichsanst., VI-2, p. 602, Taf. CXLVII, fig. 5). It is characterised by the presence of irregularly alternating ribs, which may or may not be adorned with umbilical and marginal tubercles. The marginal tubercles stand rather high above the umbilical edge. Thus in the proportion of the siphonal and lateral parts of the shell this specimen differs remarkably from *D. Harpalos* v. Dittmar.

In all these characters the present specimen agrees with *Distichites Minos*, from the upper noric stage of the Triassic Hallstatt-limestone. Unfortunately the only type of *D. Minos* is a fragmentary and partly crushed body-chamber. It is consequently impossible to establish the identity of the Indian fossil with the European species.

B. Group of *Distichites compressi.*

8. DISTICHITES YOUNGHUSBANDI nov. sp. Pl. II, figs. 1, 2.

This beautiful species is represented in the Himálayan collection by two very well preserved specimens from Tera Gádh. Both of them are entirely chambered. As the larger specimen has a diameter of 93 mm., and as another three-quarters of a volution must be reckoned for the body-chamber, the species must have attained very remarkable dimensions. In this respect it seems to have been scarcely inferior to *Distichites Ortelii* v. Mojsisovics (Die Cephalopoden der Hallstaetter Kalke, Abhandl. K.K. Geol. Reichsanst., VI-2, p. 608, Taf. CXLIX, fig. 6) and to have been only surpassed by *D. Wulfeni* Mojsisovics (l. c., p. 609, Taf. CLI, fig 1), the largest among the congeneric species.

Distichites Younghusbandi is distinguished by slowly increasing whorls, overlapping each other to the extent of one half of their height, and enclosing a proportionately wide umbilicus. The greatest transverse diameter corresponds to the sharp umbilical edge, which marks off the low, vertical umbilical wall from the gently rounded lateral parts. The latter pass quite regularly and gradually into the strongly arched siphonal part, which is interrupted by two low and smooth keels enclosing a deep median depression.

The shelly substance having been partly preserved in the larger of my two examples, I have been able to ascertain that the keels were massive, not hollow, and consisted of a compact, shelly mass, whereas all the remaining portions of the cast are covered with only a very thin layer of shell. This shell was scarcely equal to a sheet of ordinary paper in thickness and thinner than the shell of a living *Argonauta*. The sediments in which this cast was found must have been deposited in very placid waters, otherwise its excellent state of preservation would be inexplicable.

The principal elements of sculpture are numerous, slightly falciform ribs, which reach from the umbilical edge to the siphonal keel-furrows. Umbilical tubercles persist throughout all stages of growth, although they diminish in size in full-grown individuals. The lateral tubercles, which correspond to the marginal spines in the group of *Distichites megaoanthi*, are very distinctly developed in the adolescent age.

The smaller of my two examples exhibits a spiral band of strong and produced lateral tubercles, whereas in the larger specimen those produced tubercles gradually develop into elongated swellings of the ribs. In the vicinity of the aperture of the last volution even those elongated swellings of the ribs disappear and the ribs remain low and flatly reduced on their tops throughout their entire length.

Bifurcation of the ribs is the rule but sets in rather irregularly. The majority of the ribs are divided by the lateral tubercles or swellings, but a large number originate as bifurcating ribs from the umbilical tubercles. On the last volution of my larger example intermediate ribs also occur besides the principal ones. They do not reach the umbilical margin. Thus, a comparatively rich and varying ornamentation of the flanks is produced.

In younger stages of growth the ribs are sharp and narrow in the lower portion of the lateral parts and their direction is perfectly radial. It is only outside the zone of lateral tubercles that they become broad and flat and are strongly turned towards the aperture in a semilunular curve. In the last volution of the specimen illustrated in fig. 1, they are low and flat throughout their entire length.

Dimensions.

Diameter of the shell		98 mm.	59 mm
„ „ „ umbilicus		31 „	17 „
Height of the last volution	above the umbilical suture	38 „	26 „
	„ „ preceding whorl	30·5 „	18 „
Thickness of the last volution		27 „	19 „

Sutures.—The sutures agree very closely with those of *D. Loidli* Mojsisovics (l. c., Taf. CXLIX, fig. 2), but are still more complicated.

The slender pyramidal saddles are provided with large dolichophyllic incisions and the outlines of the single leaves are delicately serrated. The two wings of the siphonal lobe and the principal lateral lobe show a bifid termination, but the two terminating points are not arranged symmetrically nor are they strongly diverging as in *D. Loidli.* The siphonal lobe is divided by a very high median prominence, which nearly assumes the shape of a true saddle. The principal lateral saddle considerably surpasses the second lateral saddle in size. The latter is distinctly bipartite and united with the auxiliary series into a sort of umbilical lobe. Two small auxiliary lobes, interrupted by a rounded auxiliary saddle, stand outside the umbilical suture.

Remarks.—*Distichites Kmetyi* v. Mojsisovics (l. c. p. 607, Taf. CXLIX, fig. 4) from the noric limestone of the Sommeraukogel near Hallstatt is probably the nearest ally to this species. The general shape and involution of the shell are identical in the two forms. Differences exist only in the minor details of the ornamentation. The bifurcation of ribs is less irregular in the Alpine species, and the lateral tubercles, which are so distinctly developed in the smaller of my two examples, are replaced by elongated swellings of the ribs in equally-sized specimens of *D. Kmetyi.* The sutural line also differs by the presence of broad saddles with robust stems, a character the reverse of which is observed in *D. Younghusbandi.*

The specimen illustrated in Pl. CXLIX, fig. 5, by E. v. Mojsisovics and considered as a variety of *D. Kmetyi* differs so considerably from the type by its very strong umbilical tubercles, from which pairs of broad and occasionally bifurcating ribs originate, that it ought to be separated from that species. Its affinity to *D. Younghusbandi* seems to be rather distant only.

From *Distichites Hippocratis* v. Mojsisovics (l. c., p. 604, Taf. CXLVIII, figs. 2, 3) the present species is distinguished by its larger umbilicus and by its more numerous, irregularly bifurcating ribs.

9. DISTICHITES sp. ind. aff. YOUNGHUSBANDI Diener.

Among A. v. Krafft's collections from the Tropites-limestone of Kalapani a fragment of a species of *Distichites* has been noticed, which although not suitable for illustration must be mentioned here for the sake of completeness.

It has a diameter of 65 mm. and closely resembles *D. Younghusbandi* in its shape and involution but is distinguished by the presence of more numerous and low falciform ribs, originating from small umbilical tubercles. Lateral tubercles are absent and elongated swellings of the ribs corresponding to such tubercles have only been noticed near the beginning of the last volution. The majority of the ribs is simple, not dichotomous. The augmentation of ribs in the marginal region of the shell is chiefly due to the intercalation of secondary costæ.

A more exact examination of this species is not possible, on account of the defective preservation of the fragment.

Dimensions.—Not measurable.

Sutures.—Not known.

10. DISTICHITES REYNOLDSI nov. sp. Pl. II, fig. 3.

This is the most conspicuous species of this group, being distinguished from all European congeneric forms by its peculiar ornamentation.

The species is represented by a single but excellently preserved cast from the Tropites-limestone of Kalapani (coll. Smith). It is provided with its body-chamber to which three-quarters of the last volution belong.

The whorls, which embrace one another to the extent of more than one-half of their height, are strongly compressed and considerably higher than thick. They are bordered by nearly flat, but slightly curved lateral parts. The largest transverse diameter corresponds to the umbilical edge, which separates the flanks from the low and perpendicular umbilical wall. The siphonal margin is marked by a sharp geniculation in the slope of the lateral parts. The siphonal area is nearly flat and provided with two low but sharp keels, accompanied by deeply excavated keel-furrows, which in their depth and width correspond with the median depression.

The sculpture is not very prominent. It consists of a small number of delicate umbilical tubercles and of falciform ribs, which are crossed by two spiral lines. The places where the ribs are intersected by those spiral lines, are occasionally marked by faint traces of lateral tubercles. The primary ribs are never dichotomous but, as a rule, are arranged into fasciculi of secondary ribs, which originate from the umbilical edge and diverge gradually towards the siphonal margin. In the vicinity of the keel-furrows the low, expanded ribs become very sharp and narrow. In this region they are directed forward so strongly that some of them run parallel to the keel-furrow for some distance.

This is a type of sculpture which recalls *Distichites Wulfeni* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 609, Taf. CLI, fig. 1) or on the last whorl of *D. Hacqueti* v. Mojsisovics (l. c., p. 610, Taf. CLII, fig. 2) but nevertheless differs so widely, that it imparts to the present species the character of an isolated type among its congeneric forms

Dimensions.

Diameter of the shell		73 mm
„ „ „ umbilicus		19 „
Height of the last volution	above the umbilical suture	31 „
	„ „ preceding whorl	24 „
Thickness of the last volution		17 „

Sutures.—Of the sutures faint traces only are indicated. It is sufficient to state that they agree in general with those of *Distichites Kmetyi* v. Mojsisovics (l. c., Taf. CXLIX, fig. 4*a*).

The siphonal saddle is broad and provided with dolichophyllic indentations which do not greatly affect the stem. The principal lateral saddle is short and more slender.

11. DISTICHITES ECTOLCITIFORMIS nov. sp. Pl. II, fig. 4.

From the genus *Distichites* the nearly allied Triassic genus *Ectolcites* differs, according to the diagnosis given by E. v. Mojsisovics, by a ceratitic development of its sutural line, by the presence of radial ribs, which do not bifurcate, and by the absence of proper external keels. Among A. v. Krafft's collections from the Tropites-limestone of Kalapani a species has been noticed which holds an intermediate position between the two genera, exhibiting the peculiar characters of *Distichites* less distinctly than any of the species hitherto described.

The species is represented by a somewhat fragmentary, entirely chambered specimen, which is, however, sufficiently well preserved to allow a satisfactory diagnosis of its specific features.

In its general shape and involution my specimen recalls *Distichites Younghusbandi*, but its volutions are more strongly compressed and increase more slowly. They overlap one another to less than one-half of their height. A large umbilicus is consequently left exposed, the diameter of which is equal to the height of the last volution. The transverse section is considerably higher than thick. The greatest transverse diameter is situated a little above the umbilical margin, which is less distinctly defined than in the preceding species, at least in the inner volutions. From this point the lateral parts converge towards the siphonal area as very slightly arched planes. The siphonal area is flatly rounded and separated from the flanks by a steeply rounded margin. The demarcation between the lateral and siphonal parts is, however, less sharply marked than in *Distichites Reynoldsi*. The continuity of the siphonal curve is interrupted by a deep median furrow.

In the last volution the cast has been partly damaged by weathering and no traces of siphonal keels have been noticed. But in the inner volutions, where I succeeded in clearing a portion of the siphonal area from the adjoining matrix two very low but distinct keels are visible. Low keels of a similar character have been noticed in *Distichites Atropus* Dittm. by E. v. Mojsisovics.

The sculpture consists of very numerous, delicate and falciform ribs. A pair of ribs originates, as a rule, from a single umbilical tubercle. It must, however, be remarked that these umbilical tubercles are not regular, as in the majority of congeneric species, but are rather radially produced elevations. Some of the ribs are dichotomous. Intercalations of secondary ribs also occur, but not frequently. Traces of lateral tubercles are very faintly developed near the beginning of the penultimate whorl. In the marginal region the sculpture is gradually obliterated and disappears completely in the vicinity of the low external keels.

Dimensions.

Diameter of the shell	72 mm.
" " " umbilicus	27 "
Height of the last volution above the umbilical suture	28 "
" " preceding whorl	22 "
Thickness of the last volution	17 "

Sutures.—The sutural line differs from that of typical species of *Ectolcites* by the distinctly brachyphyllic development of the saddles. These are serrated up to their very tops, and the siphonal saddle even exhibits a tendency to the development of dolichophyllic incisions along its external wall. There is at least a marked difference in the indentations of its outer and inner walls, the latter being delicately serrated, whereas the former are affected by deep incisions.

The general character of the sutural line certainly points to a closer affinity with *Distichites* than with *Ectolcites*. If we imagine the sutures of *Distichites Kmetyi* v. Mojsisovics (l. c., Pl. CXLIX, fig. 4) without their dolichophyllic development, we shall get an exact copy of the sutures of the present species. In the character of the lobes both species agree very closely, the presence of very long finger-shaped points in their principal lateral lobes being the most remarkable feature.

The two wings of the siphonal lobe show a bifid termination, exactly as in *Distichites Loidli* v. Mojsisovics. The siphonal lobe is divided by a high and slender median prominence, which coincides with the median furrow of the cast, but remains inside the keels. The principal lateral lobe is very deep, whereas in typical species of *Ectolcites* it is comparatively short.

From the top of the second lateral saddle the sutural line slopes towards the umbilical suture without any distinctly individualised sutural elements.

Remarks.—In its general characters the present species is a true representative of the genus *Distichites*, but is rendered remarkable by the faint development of such features as are regarded as distinctive between *Distichites* and *Ectolcites*. It is provided with keels, but they are very low and small. Its sculpture is less complicated than in typical species of *Distichites*, although bifurcating ribs are not entirely absent. Its sutures are strongly brachyphyllic, neither dolichophyllic as in *Distichites*, nor ceratitic as in *Ectolcites*, but in their arrangement they agree with *Distichites*, not with *Ectolcites*.

Genus: ECTOLCITES Mojsisovics.

1. ECTOLCITES HOLLANDI nov. sp. Pl. II, fig. 5.

This is the most conspicuous species of the genus hitherto known. In its dimensions it surpasses considerably all the rest of the congeneric forms. A full-grown individual with its body-chamber from the Tropites-limestone of Lilinthi (coll. Krafft) is available for examination. Its inner volutions have been laid bare by scaling off carefully the last and penultimate whorls. In this way I have succeeded in examining the siphonal part and cross-section of the volution preceding the penultimate whorl.

The inner volutions agree entirely with those of the Alpine types of *Ectolcites*. They are widely umbilicated, increasing very slowly and embracing one another only along their siphonal parts; these are rounded, smooth and provided with a median-furrow, which is not accompanied by proper keels. The lateral parts are covered with numerous, straight, transverse ribs, which terminate in ntly developed tubercles along the siphonal margin.

In later stages of growth the shape and ornamentation of the species are subject to considerable variation. The volutions increase in height more rapidly than in width. A high-mouthed aperture is thus formed in the last volution of the figured type-specimen (fig. 5*b*). The rounded median-furrow is deepened and its lateral borders are elevated into low and sharp keels. The siphonal part becomes highly rounded.

On the two last volutions the sculpture gradually becomes less marked and the ribs are flatter and less regularly disposed. In the vicinity of the aperture two or even three ribs are occasionally met with, standing very close to each other, but separated from the adjoining ribs by wide intercostal spaces. From the faintly developed marginal tubercles, the ribs are curved forward, running across the siphonal area to the keel-shaped borders of the median depression, where they disappear. A very small number of short, intercalated ribs is restricted to the vicinity of the aperture. No bifurcation of ribs has been noticed

The marginal tubercles are connected by an elevated spiral band, which is accompanied by a similar, but less distinctly marked, spiral band outside the siphonal margin.

Dimensions.

Diameter of the shell	100 mm.
„ „ „ umbilicus	51 „
Height of the last volution { above the umbilical suture	28·5 „
Height of the last volution { „ „ preceding whorl	24 „
Thickness of the last volution	17 „

Sutures.—The sutures are not ceratitic, as in the two Alpine species of *Ectolcites*, but indistinctly brachyphyllic. Only the tops of the main saddle remain entire. In its general arrangement, however, the sutural line of the present species closely agrees with the sutures of *Ectolcites*, not of *Distichites*, especially so in the character of the siphonal lobe, which is very deep, nearly twice as d as the principal lateral lobe.

The median prominence is not clearly visible. It was apparently high and narrow. The two wings of the siphonal lobe are provided with very small indentations. The principal lateral lobe is bifid, the second lateral lobe trifid, exactly as in *Ectolcites pseudoaries* Mojsisovics. The second lateral saddle is situated on the flank and followed by a small auxiliary lobe.

If we except the faintly brachyphyllic serration of the margins of lobes and saddles in the present species, the sutural line scarcely deviates in any essential point from that of *Ectolcites pseudoaries*.

2. ECTOLCITES ARIETIFORMIS nov. sp. Pl. II, fig. 6.

Of this interesting species a single cast, consisting of air-chambers only, from the Tropites-limestone of Lilinthi (coll. Krafft) is known to me. It agrees very closely with the inner volutions of *Ectolcites Hollandi*, but for the different shape of its transverse section.

The cross-section is nearly rectangular and wider than high. Its largest diameter corresponds to the siphonal margin. The siphonal area is separated sharply from the lateral parts. It is flat, smooth and provided with a median furrow, which is not bordered by keels. The lateral parts are covered with numerous straight radial ribs, which are thickened along the marginal edge, where they terminate abruptly.

There is no other Triassic species of ammonite, which in its lateral sculpture resembles so closely some species of the liassic genus *Arietites*, especially *A. spiratissimus* Quenstedt.

It is impossible to mistake this species for the inner nucleus of *Ectolcites Hollandi*, if we take into consideration the difference in their cross-sections.

Dimensions.

Diameter of the shell	32	mm
" " " umbilicus	14·5	"
Height } of the last volution	7	"
Thickness }	9	"

Sutures.—Not known in detail, but apparently very similar to those of *Ectolcites pseudoaries* v. Mojsisovics. Lobes serrated. Saddles with entire margins.

Remarks.—The external habit of *Ectolcites arietiformis* shows some similarity to an Alpine species of the genus *Ectolcites Hochstetteri* v. Mojsisovics, especially in the arrangement of radial lateral ribs and external spines. But it differs remarkably from the latter species in the shape of its cross-section and by the presence of sharp external margins.

3. ECTOLCITES nov. sp. ind. aff. HOCHSTETTERI Mojs. Pl. II, fig. 8.

This species, represented only by two specimens from the Tropites-limestone of Kalapani and Tera Gádh (coll. Smith) is very closely related to *Ectolcites Hochstetteri* v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 615, Taf. CXXXVI, fig. 5) from the noric Hallstatt limestone of the Sommeraukogel. It is distinguished from the latter species by only very subordinate details. The radiating ribs are more numerous, closely set and less coarse and the marginal spines are less strongly developed. In general the ornamentation is more elaborate and delicate, but otherwise the relationship between the two species is most intimate.

The deep median furrow is bordered by indistinct, keel-like elevations which are touched by delicate external ribs forming a continuation of the straight radial costæ beyond the marginal spines. All the ribs are simple.

Both specimens are provided with their body-chambers. The larger one is but little inferior in size to the Alpine type-specimen illustrated by E. v. Mojsisovics.

Dimensions.—The measurements of the smaller specimen from Kalapani, which has been illustrated in fig. 8, are as follow :—

Diameter of the shell	24 mm.
„ „ „ umbilicus	12·5 „
Height } of the last volution	6 „
Thickness } of the last volution	85 „

Sutures.—Not known.

4. ECTOLCITES DUNCANI nov. sp. Pl. III, figs. 1, 2, 3; Pl. II, fig. 7. (*var.*)

This species is as nearly allied to *Ectolcites pseudoaries* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 613, Taf. CXXXVI, fig. 17) as the preceding one is to *E. Hochstetteri*. The chief feature of distinction is the character of the ribs in the body-chamber.

Ectolcites Duncani attains considerable dimensions. The specimen illustrated on Pl. III, fig. 1, is a full-grown individual and the largest known to me. Its body-chamber is entirely preserved, although the peristome itself has been injured by weathering. The two examples illustrated on the same plate, are also provided with parts of their body-chambers.

The volutions increase very slowly and overlap one another along the siphonal part only. In the proportions of height and thickness some variability has been noticed among the large number of examples by which this species is represented in the Himálayan collection. The body-chamber volution is always higher than thick, but in the cross-sections of the inner volutions a compressed and a thick variety can be distinguished. The specimen illustrated in Pl. II, fig. 7. is a good example of the latter type.

A considerable number of specimens is distinguished by obliquely elliptical or transversely elliptical outlines. As they occur together with normally coiled individuals in the same bed and at the same locality, I am not inclined to consider them as constituting an independent species.

The sculpture of the inner volutions does not differ from that of *Ectolcites pseudoaries*. It is only in the body-chamber that a change in the ornamentation is noticed. In the specimen illustrated in Pl. III, fig. 3, three phases of evolution in the sculpture are most clearly marked. Near the beginning of the penultimate whorl the ribs are straight and radial, and terminate in small marginal spines. At the end of this whorl there are no more spines present, but the ribs are strongly curved in the marginal region towards the external furrow. This is exactly the pattern of sculpture peculiar to *E. pseudoaries*. In the body-chamber whorl the ribs are no longer straight and separated by wide intercostal spaces, but set very closely to each other, more delicate and distinctly falciform. In exceptional cases dichotomous ribs originate from the umbilical margin, but the overwhelming majority of the ribs are simple and undivided.

Longitudinal striæ are less distinctly developed than in *E. pseudoaries*.

The specimen illustrated in Pl. II, fig. 7, deviates from the typical form of the species by its more numerous, densely crowded ribs.

Dimensions.

	Pl. III, fig. 1.	Pl. III, fig. 2.
Diameter of the shell	78 mm.	55 mm.
„ „ „ umbilicus	34 „	26 „
Height of the last volution	23 „	17 „
Thickness of the last volution	17 „	12·5 „

Sutures—Agreeing exactly with those of *Ectolcites pseudoaries* v. Mojs.

Locality. Number of specimens examined.—This species appears to be rather common at all localities where collections have been made in the Tropites-limestone by Smith and A. v. Krafft.

Tera Gádh 7, Kalapani 11, Kuti 3, Lilinthi 7, Nihal 4.

B. TROPITOIDEA (TRACHYOSTRACA MACRODOMA).

Family: *HALORITIDÆ*.

Genus: ISCULITES Mojsisovics.

1. ISCULITES SMITHII nov. sp. Pl. XI, fig. 25.

The only specimen available for examination was collected by Smith in the Tropites-limestone of Tera Gádh. It is provided with a part of its body-chamber. If the sinuated margin in the umbilical region at the end of the last volution should correspond to the peristome, as might be supposed, the length of the body-chamber would be only little more than three-quarters of one volution.

In its general shape and dimensions the present specimen strongly recalls the *var. obesa* of *Isculites Heimi* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 67, Taf. LXXXVII, fig. 8). The inner volutions are of nearly equal height and thickness. The umbilicus is comparatively small. The egression or opening out of the umbilical margin is insignificant up to the very end of the shell, where the margin suddenly begins to expand considerably.

From *Isculites Heimi* this species is at once distinguished by its very prominent sculpture. There is, indeed, among the congeneric forms only one, *Isculites decrescens* Hauer, which is provided with a similar ornamentation. But in *I. decrescens* the ornamentation is still more complicated, consisting, as it does, of both transverse folds and contractions, whereas in the Himálayan species only numerous transverse folds are noticed. Those ribs are most strongly developed in the vicinity of the siphonal area, where they unite in the shape of lappets with their convexity turned forwards. In the umbilical region the shell is nearly smooth. This is also the character of the transverse sculpture in *Isculites decrescens*, with the single exception that a median thread-like line along the siphonal area is absent in *I. Smithii*.

Dimensions.

Diameter of the shell	17	mm.
„ „ „ umbilicus	1	„
Height of the last volution { above the umbilical suture	9	„
„ „ preceding whorl	4·5	„
Thickness of the last volution	8	„

Sutures.—The sutural line of the last air-chamber is accessible to a detailed examination. Its investigation confirms the views of E. v. Mojsisovics, based on his study of the sutures of *Isculites subdecrescens* and *I. Heimi*.

The siphonal lobe is goniatitic and divided by a low but very broad median prominence. Each of the two wings of the siphonal lobe terminates in a single, sharp point. The outer wall of the large siphonal saddle is entire and not serrated, whereas its inner wall, bordering the principal lateral lobe, exhibits faint denticulations. The principal lateral lobe shows four deep indentations along its base. The second lateral lobe is provided with three indentations. The two lateral saddles have entire borders.

There is no auxiliary element outside the umbilical suture.

2. ISCULITES HEIMI Mojsisovics. Pl. XV, fig. 1.

1893. *Isculites Heimi* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 67, Taf. LXXXVII, figs. 8, 11, 12, 13.

1896. *Isculites cf. Heimi* E. v. Mojsisovics, Beiträge zur Kenntniss der obertriadischen Cephalopoden-faunen des Himálaya, Denkschr. Kais. Akad. d. Wiss., Bd. LXIII, p. 608.

1899. *Isculites cf. Heimi*, Palæontologia Indica, ser. XV, Himál. Foss. Vol. III, Pt. 1, Upper Triassic Cephalopod-faunæ of the Himálayas, p. 41.

This species is represented in A. v. Krafft's collections from the Tropites-limestone of Tera Gádh by a large, excellently preserved specimen, belonging to the *var. typica* and closely agreeing with the European type-specimen illustrated in fig. 11 of the monograph of the Hallstatt Cephalopoda by E. v. Mojsisovics.

The shape and character of sculpture agree with the type so closely that a detailed description of them may here be omitted.

The egression of the umbilicus sets in at the beginning of the last volution and is very considerable. There is a great variability among European specimens of this species, regarding the width of the expanding umbilicus, but my Himálayan example is one of the extreme types. Its egression is, indeed, so considerable, that the height of the last whorl is smaller near the aperture than in the middle of the volution. The last air-chamber is noticed at a distance of three-quarters of the last volution from the aperture.

The expanding mouth-margin has not been preserved.

The ornamentation consists of strong but irregularly distributed striæ of growth and of faint longitudinal lines, which are restricted to the rounded siphonal part.

Dimensions.

Diameter of the shell		26·5 mm.
,, ,, ,, umbilicus of the last volution	at the beginning	2·5 ,,
	,, ,, aperture	7 ,,
Height of the last volution	at the aperture	9·5 ,,
	,, ,, middle of the whorl	10 ,,
Thickness of the last volution		8·5 ,,

Sutures—Agreeing with these of the European representatives of *Isculites Hemii.*

Siphonal saddle serrated along its inner wall, but with entire external margin. Siphonal lobe shorter than the lateral lobe. Lateral saddle serrated up to its top which is entire. One auxiliary lobe and saddle outside the umbilical suture.

Remarks.—The only difference between this specimen and the European representatives of *Isculites Heimi,* illustrated by E. v. Mojsisovics, is its somewhat larger size. I consequently do not hesitate to venture on a direct identification.

In the Himálayan Trias *Isculites Heimi* has been recognised by E. v. Mojsisovics among the cephalopoda of the Shalshal cliff from the horizon of *Daonella Indica* Bittn.

In the Alpine Trias the species is restricted to beds of the middle carnic stage.

3. ISCULITES sp. ind. aff. OBOLINO Dittmar. Pl. XIV, fig. 5.

This slender form seems to be most closely related to *Isculites obolinus* v. Dittmar (Zur Fauna der Hallstätter Kalke, Benecke's Geognost. Palæont. Beitraege, I. Bd., p. 356, Taf. XIV, figs. 7–9) from the carnic *Ellipticus* beds of the Salzkammergut, from which it is specially distinguished by the character of its sutural line.

The only, somewhat fragmentary, specimen from the Tropites-limestone of Tera Gádh (coll. Krafft) is a weathered cast with part of the body-chamber, to which a little more than one-half of the last volution belongs. It slightly exceeds Dittmar's type-specimen in size, but the type of egression of the umbilicus and of involution is the same as in that specimen. The most remarkable character, in which it agrees entirely with *Isculites obolinus,* is its very high transverse section and flat shape. Its siphonal part is even more sharply rounded.

The ornamentation, if there ever was any, has been completely destroyed by weathering. The cast is smooth, but the shell was perhaps provided with very delicate folds, as in the majority of congeneric species.

Dimensions.

Diameter of the shell	20	mm.
„ „ „ umbilicus	7	„
Height } of the last volution	6·5	„
Thickness	4	„

Sutures.—According to the diagnosis of E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 66) *Isculites obolinus* is distinguished by very low and flat lobes and saddles. Our specimen has moderately elevated saddles and rounded lobes with ceratitic incisions at their base. The inner wall of the siphonal saddle was probably serrated, but this fact cannot be ascertained positively, on account of the sutures having been slightly injured by weathering.

The siphonal and lateral lobes are equally deep. The rounded auxiliary lobe is very low.

Remarks.—I should not have hesitated to refer this specimen to *Isculites obolinus,* but for the fact that the difference in the development of the sutures required the isolation of the Himálayan form.

Genus: HALORITES Mojsisovics.

HALORITES sp. ind. ex. aff. PROCYON v. Mojsisovics. Pl. XV, fig. 2.

Two specimens of *Halorites* from the Tropites-limestone of Kalapani are very nearly allied to the *var. obliqua* of *Halorites procyon* E. v. Mojsisovics (Palæontologia Indica, ser. XV, Himál. Foss., Vol. III, Pt. 1, p. 9, Pl. I, figs. 1-3; Pl. II, fig. 1) from the Halorites limestone of the Bambanag range.

They are casts, provided with their body-chambers, and partly injured by weathering, especially so in the umbilical region. They chiefly differ from *Halorites procyon* by their strongly oblique elliptical outline, but it is impossible to decide how far this character is produced by a periodically recurring retardation of growth in height or by accidental deformation in the rock. In view of the great variability of *Halorites procyon,* the identity of the species from the Tropites-limestone with that of the Halorites beds cannot be peremptorily denied, but for the present, having only unsatisfactory material to work on, I prefer to class it only as *sp. ind.* allied to *H. procyon.*

The figured specimen is of strongly elliptical outlines, its longer diameter exceeding the smaller one by two-thirds of its length. At the beginning of the last whorl a strong inflation of the siphonal part and adjoining portions of the flanks is noticed. But the difference between the inflated and compressed regions of this volution is less conspicuous than in the specimens of *Halorites procyon* illustrated by E. v. Mojsisovics. Near the peristome the external part is once more inflated considerably. The mouth-margin has been broken off in the figured specimen, but in my second example it has been entirely preserved. In its shape it agrees completely with the peristome of *H. Phaonis*, as illustrated by E. v. Mojsisovics on Pl. V, fig. 1*a*. of his above-quoted memoir.

The umbilical region has been partly damaged in both of my specimens. The figured specimen is provided with its shell. Its umbilicus seems to be narrow and to expand only very little. But this character cannot be satisfactorily ascertained on account of its bad state of preservation. My second specimen is a cast and was probably provided with a widely expanding umbilicus, although its egression seems to have been inferior to that in the types from the Halorites-limestone.

In the sculpture a marked difference between the anterior and posterior portion of the last volution is easily noticed. At the beginning of the body-chamber the ornamentation consists of numerous but low transverse ribs of the same pattern as in the inner volutions of *H. procyon.* The ribs are nearly straight, often bifurcating, and cross the siphonal part without any distinctly marked interruption. Gradually the ribs become more widely separated and irregular, assuming a zig-zag shape. At the mid-length of the body-chamber they disappear completely. In the meantime stout marginal knobs make their appearance along the siphonal edge. In my second specimen these marginal knobs disappear at a short distance behind the peristome. Thus, the cast is perfectly smooth in the immediate vicinity of the peristome.

Dimensions.

Diameter of the shell	58 mm.
„ „ „ umbilicus	2 „
Height of the last volution	30 „
Thickness of the last volution	23 „

Sutures.—Not known.

Subgenus : *Jovites* Mojsisovics.

The forms described in the following pages under this subgeneric designation, proposed by E. v. Mojsisovics, are represented in Smith's collections from the Tropites-limestone of Kalapani by a large number of individuals. All the forms appear at first sight to be linked together most closely by transitional shapes. Some forms, it is true, seem to constitute good species, owing to remarkable characters, but a closer examination shows conclusively that they are connected with most of the other forms by transitional shapes with rather indifferent characters. Thus, there are practically no constant features which might be regarded as equally characteristic of a number of individuals. I was consequently compelled either to distinguish a very considerable number of specimens as individual species or else to admit a comparatively wide range of variation of a single species.

I have decided in favour of the latter alternative, grouping the generality of examples in two species only.

Thanks to the extensive materials which I was able to examine—about forty specimens—I have been convinced that it is impossible to subdivide them into separate species based on the morphological comparison of single individuals only but that all the examples must be taken into consideration, in order to find out which characters remain constant within the range of variation. Thus, I have come to the conclusion, that among the numerous Himálayan examples belonging to *Jovites*, only two leading characters, can be accorded specific value, the compression of the siphonal part in the body-chamber and the strength and character of ribbing near the peristome. These two characters will therefore furnish us with a fair basis for the grouping of the numerous forms, which are all alike and all again different and are yet only vaguely limited off from one another.

According to this view, I have distinguished only two species among the representatives of the subgenus *Jovites* in the Tropites-limestone of Byans. One of them is most intimately allied to the European *J. dacus* Mojs. It has a strongly compressed aperture and is covered with numerous, but rather delicate and frequently bifurcating ribs. The second species is distinguished by a regularly rounded siphonal part in the body-chamber and by a coarser sculpture. Its affinity to *Jovites bosnensis* Mojs. is obvious. In both species the two typical forms are connected by many varieties, all of which are linked together by transitional forms

1. JOVITES DACIFORMIS nov. sp. Pl. XV, figs. 5-10 ; Pl. XVI, fig. 2.

(2) 1893. *Halorites* (*Jovites*) *sp. ind. ex. aff. daci* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsans, VI-2, p. 52, Taf. LXXXVIII, fig. 10.

The shape, sculpture and dimensions of this species are subject to considerable variations. Among the large number of forms two only have been chosen for illustration. They constitute the most remarkable types of full-grown specimens.

The length of the body-chamber comprises a complete whorl. Full-grown specimens possess a body-chamber whorl, in which the sides become gradually flattened towards the aperture. This is connected with gradual compression. Whereas near the beginning of the body-chamber the siphonal part is broadly rounded, corresponding with the considerable thickness of the volution, it becomes narrowly rounded, and in exceptional cases almost acute, in the vicinity of the aperture. The transverse section of the peristome is either higher than broad or of equal height and width. The greatest transverse diameter coincides with the umbilical margin. The opening of the umbilicus is very considerable. It begins on the last whorl before the aperture and expands as widely as in any European species of *Jovites* or *Halorites*.

The range of variation in the external characters enumerated above is remarkably wide. The periphery is either regularly rounded (Pl. XV, fig. 5), or angular (Pl. XVI, fig. 2). The sharpening of the siphonal part is more or less strongly developed. In all my specimens, however, a faint, keel-like projection persists in the middle of the siphonal part, extending as far as the peristome.

The width of the expanding umbilicus shows a wide range of variation. In some examples the opening of the umbilicus is so considerable that the height of the body-chamber volution slightly diminishes along its anterior portion up to the peristome, whilst in other specimens it is not large enough to prevent a regular, although very slow, increase of height in the last whorl.

The region of greatest inflation of the shell is also subject to some variation. In some specimens it coincides with the beginning of the body-chamber volution, in others it is shifted a quarter of a volution, or even further, anteriorly.

The inner whorls (Pl. XV, figs. 6, 7, 8) overlap one another almost completely and are very narrowly umbilicated. They are considerably thicker than high and provided with a broadly inflated siphonal part. The narrow umbilicus is surrounded by a comparatively high and vertical umbilical wall, whereas this wall is extremely low in the widely expanding body-chamber whorl. Before this opening takes place, the umbilicus is either closed by a callosity or else constricted. The keel-like projection in the middle of the siphonal part is already visible in very young stages of growth (Pl. XV, fig. 8).

The sculpture consists of numerous, but low ribs, which, as a rule, bifurcate beyond the middle of the flanks. These ribs do not keep a perfectly straight direction, but are somewhat bent forward, running from the umbilicus across the sides to the external part, where they meet in an uninterrupted line along the median keel-like projection. Short marginal ribs are frequently intercalated between the stem ribs. Thus, a considerable augmentation of ribs is caused in the vicinity of the siphonal part.

Two kinds of variation can be distinguished in the ornamentation of the shell.

Towards the peristome of the body-chamber the ribs either grow fainter and in some cases even almost completely disappear (Pl. XVI, fig. 2), or else they are separated by wider intercostal spaces and become somewhat stronger, although never so coarse as in the following species. An important character is the persistence of dichotomising ribs to the end of the last whorl. Although broad and flat, undivided ribs frequently occur on the body-chamber, most of the ribs retain the character of bifurcation. This is the only external character in which our species slightly deviates from *Jovites dacus* Mojs., in which the character of the ribs and their bifurcations does not remain the same on the body-chamber as in the earlier parts of the shell.

The peristome has been partly preserved in the specimen illustrated on Pl. XVI, fig. 2. It is not rectangular, as in the majority of European species of *Halorites*, but has a rounded periphery, as in the Indian representatives of that genus. The length of the body-chamber is larger in full-grown individuals than in small ones. It is always a little more or a little less than one entire volution.

Dimensions.

		Pl. XV, fig. 5.	Pl. XVI, fig. 2.
Diameter of the shell		90 mm.	66 mm.
Diameter of the umbilicus	at the beginning of the last whorl.	2 „	2 „
	„ „ aperture	15 „	8 „
Height	of the last volution	34 „	30·5 „
Thickness		33 „	23 „
Height	at the beginning of the last volution	27·5 „	25 „
Thickness		33 5 „	25 „
Thickness of the last volution above the preceding whorl.		18 „	13 „

Sutures.—The projection of the periphery of the preceding volution touches the inner side of the large lateral saddle in the penultimate whorl. As in *Jovites dacus*, two principal and two auxiliary saddles must therefore be distinguished. The striking contrast in the dimensions of these two kinds of saddles, characteristic of *Jovites*, is also obvious in the present species.

In the details of the sutural line considerable differences are noticed between the present species and *Jovites dacus* Mojs.

The saddles are more slender and show a richer dolichophyllic ramification of the lateral leaves, which are elongated and arranged obliquely to the median axis of the saddles. The range of variation, to which the shape of the sutural elements is liable in this species, will be readily seen from the two figures 9 and 10 on Pl. XV. But it would be of no use to describe them in detail, as actually I have not found two inner nuclei with quite identical sutures. Notwithstanding their variability they agree fairly well in their chief characters. The contrast between principal and auxiliary saddles is always distinctly marked, although more or less so in different specimens. The arrangement of indentations in lobes and saddles remains invariably the same and the siphonal saddle always surpasses the lateral one in size.

Remarks.—Some palæontologists may consider that my description of this species introduces too wide an interpretation of the range of a species in Triassic ammonites. But a separation of all the varieties would have led me into an artificial grouping of forms which are all linked together by transitional shapes. It must be borne in mind that the rather rich material of *Jovites* available to me for examination, was derived from one bed of limestone at a single place (Kalapani). For the grouping of such materials the method of distinction based on purely morphological characters is barely sufficient. The biological aspect must also be taken into consideration. According to their mode of occurrence all the ammonites united here in the species of *Jovites daciformis*, constitute one single association of forms. There they occur as a large number of individuals confined to a limited place. Thus, an enormous variability is caused by this confinement to a limited area. The specific identification of all those variations is scarcely less fairly justified than in many species of Jurassic *Terebratulidæ*, to which a purely morphological determination of species cannot be applied either.

The present species is certainly most nearly allied to *Jovites dacus* E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl K. K. Geol. Reichsanst., VI.-2, p. 49, Taf. LXXXIV, figs. 1-8) from the carnic stage of the Hallstatt-limestone.

Among my materials some examples may be found, which in their external characters agree almost entirely with those types of *Jovites dacus*, in which the change of sculpture in the body-chamber is less plainly marked than in the typical forms of the Alpine species. But I think that with extensive materials a correct idea of specific characters and of specific identity cannot be formed by a purely morphological comparison of single specimens but only by a comparison of the entire series of forms within the range of variation of a species. Nevertheless, I should, perhaps, have hesitated to separate my Indian species from *Jovites dacus* had not the different structure of the sutural line required its isolation.

In the character of the sutural line my specimens agree very closely with an Alpine species, which has been described by E. v. Mojsisovics as *Jovites sp. ind. ex. aff. daci* (l. c., p. 52, Taf. LXXXVIII, fig. 10). All the features, in which the sutural line of *Jovites daciformis* differs from that of *J. dacus* — the slender shape of the saddles, the oblique position of the larger dolichophyllic leaves, and the greater height of the siphonal saddle — are found in the sutures of this unnamed Alpine species. The differences in the details of the sutures are certainly not sufficiently important to forbid an identification of the two species. But the correctness of such an identification cannot be ascertained, because no full-grown individuals of the Alpine species are as yet known.

The species from the Daonella beds of Lauka, described as *Jovites sp. ind. ex. aff. J. daci* by E. v. Mojsisovics (Palæontologia Indica, ser. XV. Himál. Foss. Vol. III. Pt. 1, p. 19) differs from *Jovites daciformis* by its more richly ramified sutures "reminding us of the degree and manner of bifurcation of the more highly developed typical species of the genus *Halorites*."

A species, which is also very closely allied to the present one, is *Jovites nov. sp. ex. aff. bosnensis* Mojsisovics (*ibidem*, p. 18, Pl. IX, figs. 4, 5) from an exotic block in the Kiogarh range, south of Sangcha Talla (coll. Diener). The two specimens described and illustrated by E. v. Mojsisovics agree with *J. daciformis* in all those features in which they differ from *J. bosnensis*, namely, the persistence of bifurcating ribs on the body-chamber and of the low keel-like projection in the middle of the external part. The only feature of distinction between this species and *J. daciformis* consists in the larger number and smaller strength of ribs in the latter form. The details of the sutural line of the species from the Kiogarh range are not known.

Among the species of *Jovites* from the Triassic beds of Sicily described and illustrated by Gemmellaro, there is none as intimately related with the present one as *J. dacus*.

2. JOVITES SPECTABILIS nov. sp. Pl. XVI, fig. 1; Pl. IX, fig. 10 (sutures).

The second species, which I am able to distinguish among my materials of *Jovites* from Kalapani, is as nearly allied to *Jovites bosnensis* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI—2, p. 52, Taf. LXXXIII, figs. 2, 3.) as *J. daciformis* is to *J. dacus*. Under this species have been included such forms as are of more globose shape and in which the gradual compression of the last volution is followed again by a slight inflation towards the aperture and by a widening of the external part. This part is consequently not acute in the vicinity of the peristome but is regularly rounded.

Other features of difference consist in the absence of the keel-like m projection in the anterior portion of the body-chamber and in the strength and arrangement of ribs.

In the inner nuclei of both species there is no marked difference in the ornamentation of the shell. But in the penultimate whorl the sculpture is, as a rule, somewhat coarser and consists of stronger and often acute ribs which are separated by wider intercostal spaces. In the anterior portion of the body-chamber the sculpture changes into strong undivided folds, exactly as in *Jovites bosnensis*. In my type-specimen (Pl. XV, fig. 1) this character of the ornamentation is very clearly marked and its difference from the sculpture of *J. daciformis* is obvious from a comparison of the illustrations on Pl. XV, fig. 5, with those on Pl. XVI, fig. 2. It must, however, be noticed that transitional shapes between the two extreme types in both species are not entirely absent, and that a few specimens have given me some trouble in uniting them with either species.

The species is less frequently met with among my material from Kalapani than is *Jovites daciformis*.

The figured type-specimen is of moderate size. Most of the specimens are considerably larger than those of *Jovites bosnensis* illustrated by E. v. Mojsisovics and agree in their dimensions with the type from the Triassic rocks of Transsylvania, illustrated by Herbich (Das Szeklerland, Mittheilungen aus dem Jahrb. d. Koenigl. ungarischen Geol. Anstalt., 1878, p. 85, Taf. XX, fig. 2).

My type-specimen has its peristome almost entirely preserved. It is situated exactly one entire volution in front of the strongest inflation of the shell. It is bordered by two lateral lappets of flatly rounded outlines, causing a small reduction of the lumen of the tube.

Dimensions.

Diameter of the shell	. . . .	76 mm.
Diameter of the umbilicus	at the beginning of the last volution	2 „
	„ „ aperture	19 „
Height	of the last volution	19 „
Thickness		34 „
Height	at the beginning of the last volution	26 „
Thickness		36 „
Height of the last volution above the preceding whorl	. . . .	14 „

Sutures.—The character of the sutures differs from that in *Jovites bosnensis* by its richer dolichophyllic ramification and by an oblique arrangement of the lateral branches of the saddles, very similar to that in *Jovites daciformis.* The shape of the siphonal saddle somewhat recalls that of several Indian species of the genus *Halorites*, otherwise the sutural line shows the remarkable contrast between the two principal saddles and the auxiliary elements, characteristic of the subgenus *Jovites.*

I am obliged to confess that I had considerable difficulty in developing the sutures in a typical example of the species and succeeded in my attempt only after having sacrificed a number of specimens. The sutural line illustrated is the only one known to me.

Remarks.—In its external features this species agrees so closely with *Jovites bosnensis*, that I should have really been at a loss how to distinguish them, had not the difference in the sutural line justified their specific separation.

Genus: GONIONOTITES Gemmellaro.

1904. *Gonionotites* Gemmellaro, I cefalopodi del Trias superiore della regione occidentale della Sicilia, Palermo, p. 155.

The genus *Gonionotites* has been established by Gemmellaro for the accommodation of a number of large ammonites from the Trias of Sicily, which resemble *Juvavites* in the characters of their inner volutions, but differ from that genus considerably in the sculpture of the body-chamber whorl. In the majority of Sicilian species the external part is flattened and strongly inflated in the vicinity of the aperture. There are, however, some species in which this feature has not been noticed, especially *Gonionotites Maurolicoi* and *G. Destefanii.* This group of forms is represented in the Tropites-limestone of Kalapani by a large species, to which the name of Gemmellaro has been assigned in honour of the late author of the genus *Gonionotites.*

GONIONOTITES GEMMELLAROI nov. sp. Pl. XV, figs. 3, 4.

In the Himâlayan collection this beautiful species is represented by eleven examples from the Tropites-limestone of Kalapani (coll. Smith).

The full-grown individuals (fig. 3) are strongly involute, with a very narrow umbilicus, which is surrounded by a perpendicular wall. The greatest diameter of the high-mouthed aperture coincides with the umbilical margin. The cross-section is slender and cordiform, with gradually converging lateral parts and a narrowly rounded siphonal part. There is no inflation or flattening of the external area as in the majority of Sicilian species of *Gonionotites*. On the contrary, the external part is even more sharply rounded in the aperture of the last volution than in that of the penultimate whorl.

The peristome has not been preserved, but from fragments of the last volution its position can be made out with tolerable certainty. As the last sutural line is situated near the anterior end of the penultimate whorl, a little more than one entire volution belongs to the body-chamber. It is therefore evident that this species belongs to the section of *Trachyostraca macrodoma*. I am obliged to lay particular stress on this observation, since Gemmellaro in his diagnosis of the genus *Gonionotites* describes the body-chamber as measuring only three-quarters of the last volution.

The inner nuclei of full-grown individuals (fig. 4) are lower and provided with larger umbilici. The contraction of the umbilicus appears to be a gerontic feature. The cross-section is less strongly compressed, thicker and with an external part more broadly rounded.

The chief difference between full-grown individuals and inner nuclei consists in the character of the sculpture. This variation in sculpture is the principal character which induced Gemmellaro to separate the genus *Gonionotites* from *Juvavites* and its allies. The ornamentation of the inner volutions is that noticed in species of *Anatomites* belonging to the group of *Anatomites scissi*, with paulostome-furrows following the direction of the ribs. *Anatomites Ducetii* Gemmellaro (l. c., p. 202, Pl. XX, figs. 1, 2) is a species, which in its sculpture very closely agrees with inner nuclei of *Gonionotites Gemmellaroi*. The ribs are broad, flatly rounded above, and flexuous. They cross the siphonal area in a curve strongly bent forward. Some of the intercostal spaces are slightly deeper and wider than the rest. They correspond to paulostome-furrows in typical forms of *Anatomites* and are bordered posteriorly by ribs, exceeding in strength the ribs following the paulostome-furrow anteriorly. These paulostome ribs and furrows are the only ones which reach as far as the umbilical margin. All the rest of the ribs and intercostal depressions rise in the lower or upper portions of the lateral parts. The ribs increase, as a rule, by intercalation of new ones, not by bifurcation. The number of intercalated ribs increases rapidly in the vicinity of the external part.

In the last volution paulostome-ribs and furrows gradually disappear. In the figured specimen their last traces have been observed at one-half of a volution behind the peristome. At the same time the lower and middle portions of the flanks become entirely smooth. The sculpture is confined to the siphonal part and margins and consists of numerous delicate ribs of equal strength.

Where the shelly substance has been preserved, its surface is seen to be covered with numerous thread-like striæ of growth, running parallel to the direction of the ribs.

Dimensions.		Fig. 3.	Fig. 4.
Diameter of the shell		110 mm.	66 mm.
„ „ „ umbilicus		4 „	6 „
Height of the last volution	above the umbilical suture	61 „	38 „
	„ „ preceding whorl	26 „	19 „
Thickness of the last volution		27 „	26 „

Sutures.—Similar to those of the genus *Halorites*, with serial arrangement of the richly dolichophyllic saddles. Two lateral lobes are present.

Siphonal lobe comparatively short and bifid, divided by a low median prominence. Principal lateral lobe ending in a single terminal, with corresponding lateral digitations of unequal size, being divided at its base by two large converging points. Second lateral lobe divided at its base by a large central point, causing it to terminate in two equal-sized digitations. Auxiliary lobes with single terminal digitations.

Three auxiliary lobes and two auxiliary saddles stand outside the umbilical margin.

From the sutures of *Jovites* the sutural line of the present species is distinguished by the presence of two lateral lobes and by a less strongly marked contrast in the dimensions of the principal and auxiliary saddles.

Remarks.—Among the species of *Gonionotites* from the Triassic rocks of Sicily, described and illustrated by Gemmellaro, two species, *G. Maurolicoi* and *G. Distefanii*, seem to be closely allied to the present one.

G. Maurolicoi Gemmellaro (l. c., p. 165, Pl. XIV, fig. 5; XVII, figs. 14, 15; XXX, fig. 10), has less strongly compressed whorls, but its external part is neither flattened nor inflated near the aperture of the last volution, in contrast to the majority o species of *Gonionotites* from the Triassic rocks of Sicily. In its ornamentation the species mentioned as *G. sp. ind. ex. aff. Maurolicoi* by Gemmellaro (l. c. p. 181, Pl. X, fig. 7; XIII, figs. 7, 8; XIV, fig. 6) shows, perhaps, even a still greater resemblance to *G. Gemmellaroi*. In their sutures the two Sicilian forms differ from the present one by the broad and serrated median prominence of their siphonal lobe and by the arrangement of the terminal points of their lateral lobes.

In the details of the sutural line *Gonionotites Gemmellaroi* agrees best with *G. Distefanii*, Gemmellaro (l. c. p. 177, Pl. XXX, figs. 12-15). This species, which is also characterised by the absence of any marked dilatation of its external part in later stages of growth is probably the nearest ally to my Himálayan form.

Genus : JUVAVITES Mojsisovics.

The presence of representatives of the genus *Juvavites* (*sensu stricto*) in the Tropites-limestone of Byans cannot be ascertained, on account of the insufficient state of preservation of a few fragments from Tera Gádh, which might, perhaps, belong to the group of *interrupti*.

The overwhelming majority of species of *Juvavitinæ* belongs to the subgenus *Anatomites* Mojs.

Subgenus: *PARAJUVAVITES* Mojsisovics.

PARAJUVAVITES JACQUINI Mojsisovics. Pl. XVI, fig. 3.

1896. *Parajuvavites Jacquini* E. v. Mojsisovics, Beiträge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wissensch. Math. Nat. cl. Bd. LXIII, p. 595, Taf. VI, figs. 4, 7; VII, figs. 1, 2.

1899. *Parajuvavites Jacquini* E. v. Mojsisovics, Palæontologia Indica, ser. XV, Himál. Fossils, Vol. III, Pt. 1, Upper triassic cephalopod-faunæ of the Himálayas, p. 25, Pl. VI, figs. 4-7; VIV, figs. 1, 2.

Parajuvavites is one of the most characteristic subgenera of the lower noric stage in the Indian Triassic province. It agrees in its sculpture with the European group of *Juvavites interrupti*, but is distinguished by the opening out of its umbilicus beginning from the last whorl before the aperture. Thirteen species have been described by E. v. Mojsisovics from the Halorites and Hauerites beds of the Bambanag range of lower noric (lacic) age.

One of those species, *Parajuvavites Jacquini*, is represented among the fauna of the Tropites-limestone of Tera Gádh (coll. Smith) by three specimens, which agree in every respect with the Himálayan form from the Halorites limestone. Having a large number of specimens from the Bambanag range at hand for comparison, I have been able to ascertain their perfect identity.

The figured example agrees most closely with the types illustrated in figs. 4 and 5 by E. v. Mojsisovics, combining some of their individual characters. As in specimen fig. 5, the lumen of the tube shows a considerable inflation near the beginning of the last volution, whereas the zone of compression connected with a slight increase of height, coincides with a cross-section of the last whorl exactly opposite the aperture. With the example illustrated in fig. 4 (Pl. VI) by E. v. Mojsisovics, my type-specimen agrees in its sculpture, which consists of close-set ribs. The ribs are acute and, as a rule, forked, either dichotomous or divided into three. Single ribs occur rather rarely. The predominant kind of rib-division is the bipartite one

The area surrounding the opening of the umbilicus forms a narrow, smooth band. In the median region of the siphonal part the ribs are often interrupted by a narrow, smooth area, especially in the region opposite the aperture.

My other specimens possess broader ribs separated by wider intercostal spaces.

Dimensions.

Diameter of the shell		50 mm.
" " " umbilicus		8 "
Height of the last volution	above the umbilical suture	18 "
	" " preceding whorl	8·5 "
Maximum thickness of the last volution		22 "
Thickness of the last volution near the aperture		20 "

Sutures.—Not known.

Subgenus: *ANATOMITES* Mojsisovics.

The subgenus *Anatomites* is rather richly represented among my Himálayan materials from the Tropites-limestone of Byans. But the determination of the species belonging to this subgenus proved to be a very difficult task, on account of the very narrow circumscription of species introduced by E. v. Mojsisovics and Gemmellaro. Even with the best illustrations of species at hand it is almost impossible to arrive at a satisfactory determination of specimens of *Anatomites* without the type-specimens themselves available for comparison. The task becomes the more difficult, if one is obliged to consult illustrations so roughly executed as those in Gemmellaro's monograph of the cephalopoda of the Triassic faunæ of Sicily.

In the present memoir specific determinations are only given for such examples as are fairly well preserved and have been compared with Alpine type-specimens described by E. v. Mojsisovics. In the interpretation of species I have followed the views of this learned author, although they may be open to criticism, for which, however, my materials were too scanty.

All the species of this subgenus known to me, from the Tropites-limestone of Byans, belong to the group of *Anatomites intermittentes*. No representative of the group of *A. scissi* has been met with. There is only one species among them related more nearly to the Himálayan forms of *Anatomites* from the Daonella beds of the Shalshal and Bambanag cliffs than to European types.

1. ANATOMITES cf. CRASSEPLICATUS Mojsisovics, Pl. XVI, fig. 5.

1893. *Juvavites (Anatomites) crasseplicatus* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 189, Taf. XCIV, figs. 6-10.

This species is one of the most characteristic and easily recognised among the congeneric forms. It is distinguished by its globose shape, its deep contractions or paulostome-furrows and by coarse rounded ribs. Two specimens from Kalapani (coll. Smith) are referred to this Alpine species with such reserve as must be made on account of their state of growth. Both specimens consist of air-chambers only, the aperture in the figured example corresponding exactly to the last air-chamber.

Two deep paulostome-furrows are exhibited in the circumference of the last whorl. The posterior furrow is the deepest and bordered by very strong paulostome-ribs on either side. Along the anterior furrow the ribs preceding it are cut off obliquely. The ribs in the quadrant between the two furrows are less strongly marked than those near the beginning of the last volution. In this respect my specimen agrees exactly with the example from the Subbullatus-beds of Aussee, illustrated by E. v. Mojsisovics in fig. 8 (Pl. XCIV).

In front of each paulostome-furrow the ribs are less broad and coarse, but gradually increase in width and strength towards the succeeding furrow. They are always wider than the rounded intercostal valleys.

No opening-out of the umbilical margin has been noticed.

Dimensions.

Diameter of the shell		36 mm
„ „ „ umbilicus		2·5 „
Height of the last volution	above the umbilical suture	20 „
	„ „ preceding whorl	11 „
Thickness of the last volution		20 „

Sutures.—The sutures of the Alpine types were not known to E v. Mojsisovics. I have succeeded in developing the sutural line in the figured specimen from Kalapani. In its arrangement and in the degree of denticulation it recalls the sutures of *Anatomites Koninoki* Mojsisovics (l.c.p. 123, Taf. XCI, fig. 11).

The siphonal lobe is moderately deep, bifid, and divided by a very broad median prominence. Each of its two wings terminates in a single, sharp point. The principal lateral lobe ends in a single terminal digitation, with corresponding lateral ones on either side. The second lateral lobe is divided at its base by a large central point causing it to terminate in two equal-sized digitations.

The siphonal saddle is the largest. It is high and broad and serrated along its margins. The two lateral saddles are more slender but also provided with brachyphyllic serration.

One auxiliary saddle is situated outside the umbilical suture.

2. ANATOMITES SPECIOSUS nov. sp. Pl. XVI, fig. 9.

This is a very characteristic species of the group of *Anatomites intermittentes*, distinguished by its very prominent sculpture, broad paulostome-furrows and remarkably catenate ribs.

The only specimen available for examination from the Tropites-limestone of Nihal (coll. Kraft) is a high-mouthed shell, with a strongly compressed and nearly trapezoidal cross-section. The lateral parts are almost flat and converge towards the flattened siphonal area, from which they are marked off by bluntly rounded external margins

The two halves of the shell are symmetrical and the lateral ribs correspond regularly on either side of the median line of the external area In the anterior portion of the body-chamber volution the ribs unite along the external part without any interruption in the shape of forward-turned lappets. In the posterior part of the last whorl, however, a slight interruption runs like a smooth band through the transverse ribs along the median line of the siphonal area.

The lateral ribs are sharp and narrow and separated by wide intercostal spaces. There are four broad and deep paulostome-furrows in the circumference of the last volution. The ribs preceding each paulostome, surpass in strength all other ribs and

have the typical character of chain (catenate) ribs cutting off obliquely numerous bundles of single, dichotomous and even tripartite ribs. The division of the bundles of ribs between two paulostomes is nine to tenfold.

Dimensions.

Diameter of the shell		36 mm.
„ „ „ umbilicus		3 „
Height of the last volution	above the umbilical suture	19 „
	„ „ preceding whorl	12 „
Thickness of the last volution		13 „

Sutures.—Not known.

Remarks. *Anatomites Caroli* v. Mojsisovics (Upper Triassic Cephalopoda-fauna of the Himálayas, Palæontologia Indica, ser. XV, Himál. Foss., Vol. III, Pt. 1, p. 37, Pl. XI, fig. 2) from the carnic Daonella beds of the Shalshal cliff is very nearly allied to the present species, agreeing with it in the number of paulostome-furrows and in the character of the ribs occurring in the areas between the paulostomes The division of the bundles of ribs cut off by a paulostome-rib, is eleven to twelve-fold in *A. Caroli*, but this difference is rather insignificant in comparison with the remarkable agreement in the general arrangement of the sculpture. In the outlines, however, the present form differs so considerably from ***Anatomites Caroli***, that its separation as an independent species is required.

Among Alpine species ***Anatomites subrotundus*** v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 103, Taf. XC, fig. 5) may be compared with the present form. But the features of distinction between them—globose shape, larger number of paulostomes, broader ribs and norrower intercostal valleys in the European form—are obvious at a glance from the respective illustrations. *A. Brocchii* Mojsisovics (l. c. p. 104, Taf. XC, fig. 10) also shows a distant resemblance to ***A. speciosus.***

Among the species of *Anatomites* from the Triassic rocks of Sicily ***A. quisquinaensis*** Gemmellaro (I cefalopodi del Trias superiore della regione occidentale della Sicilia, p. 214) is perhaps nearly allied to the present one. Gemmellaro describes it as resembling *A. Brocchii* and *A. Gelonis* in its sculpture, but differing from those two species by its less globose outlines and flattened lateral parts. In both of those characters it might therefore agree with ***A. speciosus.*** But any closer comparison is impossible, because no illustration of the Sicilian species is given in Professor Gemmellaro's memoir.

3. ANATOMITES cf. THEODORI Mojsisovics. Pl. XVI, fig. 4.

1893 *Juravites (Anatomites) Theodori* v Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst, VI-2, p. 127, Taf. XCII, fig. 16.

A single specimen from the Tropites-limestone of Kalapani (coll. Smith) agrees in its outlines, dimensions, number of paulostomes and arrangement of ribs with ***Anatomites Theodori*** Mois. from the carnic Subbullatus-beds of Aussee.

There are only two paulostome-furrows in the circumference of the last volution. The ribs between them are of nearly equal strength. The insignificant development of the difference in the strength of ribs in the anterior and posterior portions of a quadrant between two paulostomes is the most important character in *A. Theodori*. It is also clearly marked in my Himálayan specimen. Only the two ribs bordering the paulostome-furrows on either side, are more prominent than the rest. Most of the ribs are dichotomous. The division of the catenate bundle, which is cut off by the foremost paulostome-rib, is six-fold.

The siphonal part is crossed by the ribs in uninterrupted curves

Dimensions.

Diameter of the shell		24 mm.
" " " umbilicus		ca. 1·5 "
Height of the last volution	above the umbilical suture	13·5 "
	" " preceding whorl	8 "
Thickness of the last volution		12 "

Sutures.—Not known.

Remarks.—*Anatomites consanguineus* Gemmellaro (I cefalopodi del Trias superiore della regione occidentale della Sicilia, p. 219, Pl. XX, figs. 9-11), from the Triassic rocks of Foudo Modanesi near Castronovo in Sicily, is also closely allied to the present species. It differs by its more compressed whorls, by the nearly smooth surface of the lower portion of its body-chamber and by a comparatively broad interruption of the ribs along the median line of the external part.

4. ANATOMITES BERESFORDI nov. sp. Pl. XVI, fig. 8.

This species is comparable to *Anatomites intermittens* v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 112, Taf. XCIII, figs. 6-10) and *A. Mauritii* v. Mojsisovics (*ibid.*, p. 113, Taf. XCI, fig. 10) from the carnic Hallstatt-limestone of the Salzkammergut.

Anatomites intermittens shows special resemblance to the species here described, of which two examples from the Tropites-limestone of Kalapani (coll. Smith) are available for examination. Both of them agree in the outlines of the shell, in the presence of broad and strong ribs preceding the paulostome-furrows, and in the partial obliteration of sculpture in the lower portion of the quadrant between two paulostome-ribs. They differ, however, in some minor details of ornamentation, which necessitate the Indian form being made an independent species.

In the circumference of the last volution, which forms part of the body-chamber, four paulostomes are counted. They are small and low and chiefly marked by the presence of strong and broad, forked ribs bordering them along their posterior margin. The foremost paulostome is almost completely obliterated.

The most conspicuous element in the sculpture of this species is the character of the paulostome-ribs. They are broad and coarse, contrasting remarkably with the rest of the ribs in strength and consisting of two ribs, which unite in the umbilical margin. In this character the present species agrees entirely with *A. intermittens*. But the number of ribs originating from a division of those paulostome-ribs differs considerably. In *A. intermittens* each of the two stem-ribs is only dichotomous, whereas in the present species the anterior rib is tripartite and the posterior one a true catenate rib, cutting off a bundle of ribs, the division of which is five to six-fold.

All the ribs between the paulostome-ribs are very delicate and restricted to the central and marginal regions of the shell. They attain their greatest development where they cross the siphonal part. All the ribs unite regularly from both sides along the median line of the external part. There is no smooth band interrupting the external sculpture, as in *A. intermittens*. The ribs are curved over the external part with their convexity turned anteriorly.

Dimensions.

Diameter of the shell	38	mm.
„ „ umbilicus	8·5	„
Height of the last volution { above the umbilical suture	21	„
Height of the last volution { „ „ preceding whorl	18	„
Thickness of the last volution	16·5	„

Sutures.—Not known.

Remarks.—This species is also allied to *A. Mauritii* Mojs., from which it differs by the more prominent sculpture of its body-chamber, by its rounded siphonal part, by a larger number of paulostomes and by the presence of fasciculate ribs.

Among the species of *Anatomites* from the Triassic rocks of Sicily, there is only a single one, *A. Curionii* Gemmellaro (I cefalopodi del Trias superiore della regione occidentale della Sicilia, p. 219, Pl. VI, figs. 4, 5; XX, figs. 12, 13) comparable to our Indian form. But its sculpture is more irregular and the difference in the strength of paulostome-ribs and ordinary ribs is less clearly marked.

5. ANATOMITES cf. FISCHERI Mojsisovics. Pl. XVI, fig. 10.

1893 *Juvavites (Anatomites) Fischeri* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 124, Taf. XCII, figs. 4, 5, Taf. CXXIX, fig. 21.

The specimen figured from the Tropites-limestone of Kalapani (coll. Smith) seems to be most closely related to *Anatomites Fischeri* Mojs. from the Ellipticus-beds of the Salzkammergut and is probably only a variety of that species. In its shape it differs slightly from the Alpine type-specimen by its more strongly compressed volutions, but this character can scarcely be considered as a feature of specific importance, as in the European *A. Fischeri* itself it is subject to considerable variability. It only needs a glance at the cross-sections of the three examples illustrated by E. v. Mojsisovics, to see the wide range of variation existing in the proportions of height and width of the tube.

Apart from its less globose shape my specimen agrees fairly well with the Alpine types in its ornamentation, especially so with the variety illustrated in fig. 21 (Pl. CXXIX).

Three paulostome-furrows are counted in the circumference of the last volution. In front of each furrow the sculpture almost disappears. The furrows are very deep and wide and bordered posteriorly by broad folds. All the ribs are close-set, broad and comparatively low. In the paulostome-ribs the catenate character is very distinctly developed. It cut off obliquely a bundle of ribs, whose division is six-fold.

The sculpture of the quadrant between the middle and hindmost paulostome-furrows agrees remarkably well with the ornamentation in the corresponding region of the above-quoted Alpine example.

In the vicinity of the aperture all the ribs diminish in strength. Even the foremost paulostome-rib is comparatively low.

The ribs either cross the external part in an uninterrupted, prominent lappet, with its convexity turned forward, or alternate on either side of the median line.

Dimensions.

Diameter of the shell		41 mm.
„ „ umbilicus		4 „
Height of the last volution	above the umbilical suture	25 „
	„ „ preceding whorl	14 „
Thickness of the last volution		18 „

Sutures.—Not known.

6. Anatomites sp. ind. aff. Fischeri Mojs. Pl. XVI, fig. 6.

A single incomplete specimen from Kalapani belongs probably to a new species, which seems to be more nearly allied to *Anatomites Fischeri* than to any other Alpine type described by E. v. Mojsisovics. In the Triassic fauna of Sicily *Antomites Beneckei* Gemmellaro (I cefalopodi del Trias superiore della parte occidentale della Sicilia, p. 210, Pl. XVII, figs. 5, 6) seems at first glance to possess a great similarity to the present species, especially so in the development of paulostome-ribs and furrows, but a more minute examination shows that the affinity of the two forms is only a rather distant one.

My specimen is of globose shape, with a regularly rounded siphonal part and with volutions of equal height and thickness. It shows only two paulostomes but in the complete shell there were probably three paulostomes in the circumference of the last volution.

The paulostome-furrows are deep and wide and bordered on either side by sharp ribs, which, however, do not surpass the other ribs in strength. The ribs preceding the anterior paulostome are considerably stronger than those in the quadrant between the two paulostomes. All the ribs are undivided. The bundle, which is cut off obliquely by the paulostome rib bordering the posterior margin of the furrow, consists of five single ribs. The ribs are arranged symmetrically on both sides of the shell and cross the siphonal part in an uninterrupted forward-turned curve.

Dimensions.

Diameter of the shell		38	mm.
" " " umbilicus		5·5	"
Height	of the last volution	18·5	"
Thickness		19	"

Sutures.—Not known.

7. ANATOMITES cf. EDGARI Mojsisovics. Pl. XVI, fig. 7.

1893. *Juvavites (Anatomites) Edgari* v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 125, Taf. XCII, figs. 13, 14.

Two specimens from the Tropites-limestone of Kalapani are comparable to *Anatomites Edgari* v. Mojsisovics, or probably even identical with that species.

In size and outlines they agree with the smaller variety illustrated by E. v. Mojsisovics in fig. 13, distinguished by the insignificant curvature of its paulostomes and by the rudimentary development of catenate ribs.

The paulostome-furrows are neither very broad nor deep. There are three paulostomes in the circumference of the last volution. In the figured specimen the first paulostome is situated exactly at the beginning of the last volution and is hidden in the lateral view by the adherent matrix. The ribs are very numerous, close-set and narrow. The majority of them are dichotomous but frequently two dichotomous ribs are united into a short stem-rib before reaching the umbilical margin.

The division of the catenate ribs which are cut off by the paulostome, is four to five-fold, exactly as in the above-quoted specimen of *A. Edgari*.

The ribs are arranged symmetrically on both sides of the shell, but the ornamentation grows very faint along a narrow band on the external part, which does not correspond exactly with the median axis of the shell.

Dimensions.

Diameter of the shell		29	mm.
" " " umbilicus		2	"
Height of the last volution	above the umbilical suture	16	"
	" " preceding whorl	9	"
Thickness of the last volution		20	"

Sutures.—Agreeing with those of *Anatomites crasseplicatus* and of *Juvavites Konincki* in general arrangement and degree of denticulation. The siphonal and principal lateral lobes are equally deep. Saddles slender, brachyphyllic and serrated up to their tops. The siphonal saddle is the largest.

Family: *SIBIRITIDÆ* Mojs.

Genus: SIBIRITES v. Mojsisovics.

SIBIRITES (METASIBIRITES) PHILIPPII nov. sp. Pl. XVI, fig. 11.

A specimen from the Tropites-limestone of Kalapani (coll. Krafft) appears to be closely allied to the Hallstatt types of *Metasibirites*, especially to *Metasibirites annulosus* E. v. Mojsisovics (Cephalopoden der Hallstaetter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 330, Taf. CXXIV, figs. 8-10) and *M. Uhligi* v. Mojsisovics, (*ibidem*, p. 331, Taf. CXXIV, figs. 5, 6). As in the true *Metasibirites* the bifurcation of the ribs occurs in the lower portion of the lateral parts, often quite near the umbilical margin, not in marginal spines, as in the subgenus *Thetidites*.

The only specimen available for examination is widely umbilicated, with slowly increasing whorls and with a low aperture. The umbilical and siphonal margins are distinctly separated from the lateral parts. The sides are flat but the siphonal area is regularly rounded.

The inner volutions have been partly injured by weathering. Their sculpture is not accessible to observation. In the penultimate and last volutions the lateral ornamentation consists of straight radial ribs, which are either single or dichotomous. The bifurcation of dichotomous ribs occurs in the umbilical margin, exactly as in the type-specimen of *Metasibirites annulosus* Mojs. (l. c., fig. 9). The point of bifurcation is not marked by any tubercle or prominence.

In the penultimate whorl most of the ribs are dichotomous, but in the last volutions undivided ribs predominate. Both the single and dichotomous ribs cross the siphonal area with a curve strongly bent forward. Near the siphonal margin they become more prominent, but do not form distinct tubercles In the middle of the siphonal area the ornamentation grows fainter. A few of the ribs are doubled while passing over the external area.

Dimensions.

Diameter of the shell	17 mm.
" " " umbilicus	8 "
Height } of the last volution	5 "
Thickness } of the last volution	6·5 "

Sutures.—Not known.

Remarks.—The relation of the present species to the genus *Sibirites* cannot be ascertained positively, as the length of its body-chamber is not known. The identification with *Metasibirites* is, it is true, most probably correct on account of its very close agreement with *Metasibirites annulosus* Mojs. in shape and sculpture. Nevertheless its possible relationship with *Buchites* Mojs. must also be taken into consideration. The length of the body-chamber being unknown, a decision must be deferred until better materials have been obtained.

If the reference to *Metasibirites* should be proved to be correct, the present species would take a rather isolated position in the Indian upper Trias, where the genus *Sibirites* has hitherto been known to be represented only by such types as have been united in the subgenus *Thetidites* by E. v. Mojsisovics.

Family: *TROPITIDAE* Mojs.

Genus: EUTOMOCERAS Hyatt.

A. Group of *Eutomocerata punctata*.

1. EUTOMOCERAS KRAFFTI nov. sp. Pl. V, fig. 1.

The specimen figured from the Tropites-limestone of Kalapani (coll. Krafft), broken as it is at the beginning of the body-chamber, is closely related to *Eutomoceras Lauræ* v. Mojosisvics (Cephalopoden der Hallstaetter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 294, Taf. CXXXI, figs. 13, 16-18, Taf. CXCIII, fig. 3), from which it differs by its large size, by the smaller number of spiral rows of spines, and by the arrangement of its sutural line.

The strongly compressed and high-mouthed volutions are provided with flatly-arched lateral parts, which converge gradually towards the siphonal area. The external area is broader than in *Eutomoceras Lauræ* or in *E. sandlingense* v. Hauer and is flat, not highly rounded as in the majority of congeneric species. The median keel is low and narrow. The deep umbilicus is surrounded by a perpendicular wall and separated from the lateral parts by a bluntly-rounded marginal edge.

The ribbing agrees with that of *Eutomoceras Lauræ*. From the umbilical to the siphonal margin the number of ribs increases either by bifurcation or by intercalation. Near the beginning of the last volution five spiral rows of spines are distinctly marked. The spines of the marginal and central lateral rows are spirally elongated The umbilical tubercles are coarse and more strongly developed than the rest. In the anterior portion of the last whorl all the marginal and lateral spiral rows of spines are gradually replaced by spiral bands or lines, which differ from the numerous and delicate spiral striæ crossing the surface of the shell by their greater strength. Only the umbilical and the lowest lateral rows of spines persist throughout the entire length of the volution.

The gradual obliteration of spiral tubercles is a character which has also been noticed in *E. Lauræ* by E. v. Mojsisovics. *E. quinquepunctatum* v. Mojsisovics (l. c., p. 293, Taf. CXXXI, figs. 12, 15), which agrees with my Himálayan specimen in the number of spiral rows of spines, differs from it in the shape of its ribs, which are straight, not sigmoidal.

Dimensions.—The measurements of this specimen, taken along the broken inner margin are as follows:—

Diameter of the shell	104 mm.
" " " umbilicus	12 "
Height of the last volution	62 "
Thickness of the last volution	25 "

Sutures.—The sutural line differs considerably from that of *E. Lauræ*, especially in the stronger individualisation of the second lateral saddle.

Siphonal lobe deep and divided by a very broad median prominence. Principal lateral lobe a little deeper than the siphonal lobe, and terminating in elongated digitations, the central one being the deepest.

Second lateral lobe terminating in two points of unequal length, which are separated by a large indentation. Saddles dolichophyllic, pyramidal and slender. Their base is considerably less broad than in *E. sandlingense* or in *E. Lauræ*. Principal lateral saddle surpassing the siphonal in height. The second lateral saddle is well individualised and higher than the following elements of the auxiliary series.

Remarks.—The species which seems to be most nearly allied to the present one, is *Eutomoceras Catherinæ* Gemmellaro (I cefalopodi del Trias superiore della parte occidentale della Sicilia, p. 92, Pl. XXIX. figs. 25-27) from the Triassic limestone of San Stefano Quisquina in Sicily. It agrees with *E. Kraffti* in the strong development of the umbilical and lateral rows of spines and in the arrangement of the sutural line. It is only in some subordinate details that the sutures of the two species differ.

As a feature of distinction the different character of the siphonal area must be considered, which is narrower and provided with a high median keel in *E. Catherinæ*.

B. Group of *Eutomocerata striata.*

2. EUTOMOCERAS MOJSISOVICSI, nov. sp. Pl. V, fig. 2.

1896. *Eutomoceras nov. f. ind. cf. E. Plinii* v. Mojsisovics, Beitraege zur Kenntniss der obertriadischen Cephalopodenfaunen des Himalaya, Denkschr. Kais. Akad. d. Wissensch. Math. nat. Cl. Bd. LXII, p. 617.

1899. *Eutomoceras nov. f. ind. cf. E. Plinii*, v. Mojsisovics, Palæont. Indica, ser. XV, Himal. Foss., Vol. III. Pt. 1, p. 48.

In Griesbach's collection from Kalapani this species was represented by a weathered cast unfit for illustration, which was referred by E. v. Mojsisovics to a new species of *Eutomoceras* of the group of *E. Plinii*. From the same locality (coll. Smith) a well preserved, entirely chambered specimen lies before me, which apparently belongs to the same species as Griesbach's cast.

As has been remarked by E. v. Mojsisovics, the shape and sculpture agree in essential points with *E. Plinii* Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 289, Taf. CXXX, figs. 4, 5, 6). The shell is strongly compressed, high-mouthed and provided with a very narrow umbilicus.

The lateral parts are flat and converge gradually towards the narrow, sharply-rounded siphonal area. The median keel is low and not laced at its base.

The ornamentation consists of very flat ribs, which broaden out considerably towards the siphonal margin, and are interrupted by narrow intercostal valleys. The ribs slope down with perpendicular walls to the intercostal furrows. This is exactly the pattern of ornamentation which has been described by E. v. Mojsisovics in *Eutomoceras Theron* and *E. Plinii* from the carnic stage of the Hallstatt-limestone. From *E. Theron* our species differs by the absence of umbilical tubercles, corresponding with the origin of the fasciculi of ribs, from *E. Plinii* by the smaller number of ribs, which are less distinctly falciform, being nearly straight, and slightly sigmoidal only in the marginal region of the shell.

Spiral striæ are distinctly developed and some of them even as strongly marked as in *E. sandlingense* Hauer.

Dimensions.

Diameter of the shell	61	mm.
„ „ , umbilicus	5	„
Height of the last volution	36·5	„
Thickness of the last volution	14	„

Sutures.—The chief difference between the present species and *Eutomoceras Plinii* consists in the development of the sutural lines. *E. Plinii* is distinguished from all other congeneric forms by its complicated sutures, some elements of which have reached a leptophyllic stage of development. This is especially the case in the siphonal saddle, of which the external margin is provided with large accessory indentations.

The sutures of *E. Mojsisovicsi* are dolichophyllic. The siphonal lobe is shorter than the principal lateral lobe The saddles are slender, recalling in shape those of *E. Theron* v. Dittm., but the principal lateral saddle surpasses the siphonal saddle in height. The second lateral saddle is distinctly individualized, not united with the auxiliary series into a suspensive lobe as in *E. denudatum* Mojs. The auxiliary series is not entirely known to me. An auxiliary lobe and saddle stand outside the umbilical margin. The auxiliary lobes following along the steep umbilical wall have been too much injured by weathering to permit an examination of their details.

3. EUTOMOCERAS sp. ind. cf. SANDLINGENSE Hauer.

1849. *Ammonites sandlingensis* F. v. Hauer, Uber neue Cephalopoden aus den Marmorschichten von Hallstatt und Aussee, Haidingers Naturwiss. Abhandl. III, p. 10, Taf. III, figs. 10-12.

1866. *Ammonites sandlingensis* A. v. Dittmar, Zur Fauna der Hallstatter Kalke, Geognost. Palæont. Beitraege von Benecke, Schloenbach und Waagen I, p. 370.

1893 *Eutomoceras sandlingense* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K Geol. Reichsanst., VI-2, p. 285, Taf. CXXX, figs. 11-13, CXXXI, figs. 1-11.

1896. *E ind. cf. sandlingense* E. v. Mojsisovics, Denkschr. Kais. Akad. d. Wissensch. LXIII, p. 614.

1899. *E. sp. ind. cf. sandlingense* E. v. Mojsisovics, Palæontologia Indica, ser. XV, Himál. Foss. Vol. III, Pt 1? p. 49.

1904. *E. sandlingense* Gemmellaro, I cephalopodi del Trias superiore della parte occidentale della Sicilia, p. 77, Taf. VIII, figs. 8-10.

Some fragments not suitable for illustration from the Tropites-limestone of Kalapani (coll. Griesbach) were provisionally referred to this species by E. v. Mojsisovics. In Smith's collections from the same locality *E. sandlingense* is most probably also represented, but, unfortunately, imperfect fragments only have been obtained, not sufficient to enable one to come to an absolutely certain decision as to their perfect identity with that wide-spread European species.

One fragment especially agrees very closely with the broadly ribbed variety of *E. sandlingense* both in its ornamentation and sutures. It has not been figured, on account of its poor state of preservation.

Genus: MARGARITES Mojsisovics.

A. Group of *Margarites bispinosi* Mojs.

1. MARGARITES cf. AUCTUS, v. Dittmar. Pl. III, fig. 4.

1866. *Ammonites auctus* A. v. Dittmar, Zur Fauna der Hallstätter Kalke, Geognost. Palæont. Beiträge von Benecke, Waagen und Schlœnbach, Bd. I, p. 367.

1893. *Margarites auctus* v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 305, Taf. CXVIII, fig. 13, CXXVIII, fig. 2

Two specimens from the Tropites-limestone of Kalapani (coll. Smith) agree very closely with the large type-specimen of *Margarites auctus* from the Subbullatus beds of Aussee.

The figured specimen is distinguished by thicker whorls, which are considerably broader than high, but in my second example the cross-section of the last volution is of equal height and width, exactly as in the European type.

In the last volution the sculpture consists of three rows of spines of unequal strength. The marginal spines are the strongest. The external spines are more delicate than the umbilical and marginal ones.

The umbilical and marginal spines are connected by straight ribs, which do not follow an exactly radial direction but are slightly turned backwards. The umbilical and marginal spines occur in equal numbers, but the external spines are more numerous, bifurcation of the ribs being noticed occasionally in the marginal spines. In the fragment of the last volution of the specimen figured seven marginal and nine to ten external spines are counted. In my second example ten marginal spines correspond to fourteen external ones in the anterior half of the last volution. In *Margarites auctus* bifurcation of the ribs also occurs occasionally in the marginal spines, but a little less frequently. This is the only character of difference between the Himálayan and European specimens which I have to mention, but I do not consider it to be of sufficient importance to preclude their identification.

In the external spines bifurcation of the ribs sets in regularly, exactly as in the European types of *M. auctus*. The external ribs, which are more delicate than the lateral ones, reach as far as the narrow median keel, which is not bordered by external furrows. A delicate longitudinal striation of the siphonal area is distinctly developed in both of my examples.

The point at which the external part becomes highly rounded and covered with accessory spines, can be fixed with full certainty in the specimen figured. At the beginning of the penultimate whorl the siphonal area is flatly curved and bordered by sharp margins, coinciding exactly with the position of the coarse spines in which the straight lateral ribs terminate. Very delicate external ribs extend from this margin to the median keel and faint traces of an accessory row of external spines are noticed in the immediate vicinity of the siphonal margin. It is only in the penultimate whorl that those accessory prominences are gradually converted into well individualized spines, that the marginal spines are shifted from their original position towards the middle of the flanks, and that the flat external part becomes highly rounded.

In the inner volutions of this species the marginal spines are very prominent and placed exactly at the umbilical suture of the following whorl.

Dimensions.

Diameter of the shell	ca.	67 mm.
„ „ „ umbilicus	„	30 „
Height of the last volution { above the umbilical suture	„	21 „
„ „ preceding whorl	„	18 „
Thickness of the last volution	„	28 „

Sutures.—Not known.

Remarks.—The present species is certainly very nearly allied to ***M. ornatissimus*** Gemmellaro (I cephalopodi del Trias sup. della parte occ. della Sicilia, p. 128, Pl. XXV, figs. 30, 31). As features of distinction from ***M. auctus*** the following have been enumerated by Gemmellaro: a wider umbilicus, a rounded base to the marginal spines, and the presence of keel-furrows. My specimen has marginal spines with a rounded base, but no keel-furrows.

2. Margarites Sushena nov. sp. Pl. III, fig. 5.

This species is very nearly allied to ***Margarites auctus*** v. Dittmar. The chief difference consists in the regular bifurcation of ribs in the marginal spines. A second bifurcation occurs with equal regularity in the external spines. Thus the number of external ribs touching the median keel is twice the number of ribs between the marginal and external spines and four times the number of radial ribs.

Of two specimens available for examination the illustrated one is of slightly elliptical outlines, whereas the other shows the normal spiral of involution. I consider this difference to be purely accidental only.

The keel, which has been perfectly preserved, is faintly crenulated, high and narrow.

Dimensions.

Diameter of the shell		39 mm.
„ „ „ umbilicus		17 „
Height	of the last volution	14 „
Thickness	of the last volution	14 „

Sutures.—Not known.

Locality. Number of specimens examined.—Kalapani 2, coll. Smith.

3. MARGARITES nov. sp. ex aff. AUCTO Dittm. Pl. III, fig. 6.

There is a second species of *Margarites* nearly allied to *M. auctus* v. Dittmar, among my materials from Kalapani (coll. Smith). It is represented unfortunately by a single, though fairly well preserved, fragmentary specimen. I consequently refrain from proposing a new specific denomination.

My specimen agrees almost exactly with *Margarites Sushena* in its dimensions and outlines, but differs from it by its ornamentation. The ribs bifurcate in the umbilical and marginal, not in the external, spines. Thus the number of marginal and external spines is equal and twice as great as that of the umbilical spines. The marginal spines are situated considerably nearer the keel than in the preceding species. The external spines are less strongly developed and are absorbed in the last volution in two parallel rows of spirally elongated accessory spines.

The umbilical wall is comparatively high, with a steeply inclined slope, and is also covered with sharp and strong ribs, originating at the umbilical suture and running backward to the umbilical spines.

Dimensions.

Diameter of the shell		37 mm.
„ „ „ umbilicus		12 „
Height of the last volution	above the umbilical suture	12 „
	„ „ preceding whorl	10.5 „
Thickness of the last volution		17 „

Sutures.—Not known.

4. MARGARITES cf. CIRCUMSPINATUS v. Mojsisovics. Pl. III, fig. 7, Pl. I, fig. 7.

1893. *Margarites circumspinatus* v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 299, Taf. CXVII, figs. 1-6, 9, 10.

1904. *Margarites circumspinatus* Gemmellaro, I cefalopodi del Trias superiore della parte occidentale della Sicilia, p. 124.

The specimen from Kalapani (coll. Smith) illustrated on Pl. III, fig. 7, agrees very closely with numerous examples of *Margarites circumspinatus* from the carnic Hallstatt-limestone of the Salzkammergut. It is somewhat distorted by pressure and drawn out obliquely. The only difference between this specimen and the

European types consists in the greater width of the cross-section. In this respect it even surpasses the example from the Ellipticus-beds of the Feuerkogel, illustrated in fig. 3 by E. v. Mojsisovics. It is on account of this difference in the proportions of height and thickness of the cross-section, that I have referred my Himálayan specimens to *Margarites circumspinatus* as *cf.* only. Otherwise their specific identity could not be questioned.

The sculpture is exactly the same as in *M. circumspinatus.* The marginal spines are very strongly developed. In the inner volutions they are seen as sharply pointed thorns, firmly appressed to the umbilical wall of the following whorl. Umbilical spines make their first appearance near the beginning of the penultimate volution. A distinct umbilical margin is developed at the same stage of growth. Umbilical and marginal spines are connected by broad and straight, flatly-arched ribs, which are simple, never dichotomous as in the species illustrated in Pl. CXVIII, figs. 5. 6, by E. v. Mojsisovics.

On the siphonal area two external ribs originate from a single marginal spine. Accessory ribs are occasionally intercalated between two spines, but not regularly. The keel is smooth and bordered by deep keel-furrows. It is laced at its base and therefore broken off easily. This has been the case in the specimen from Tera Gádh (coll. Krafft) which has been illustrated in Pl. I, fig. 7. The example is a cast entirely devoid of shell and might from a cursory examination easily be mistaken for a species of *Distichites.* The keel is entirely wanting and the deep, rounded median furrow in the external area recalls a species of the genus *Distichites,* although external keels bordering the median depression are absent. It is not only the shape of the cross-section and sculpture, by which the identity of his fragment with *Margarites circumspinatus* has been proved, but especially the fact, that along the internal side of the fragment a median furrow has also been noticed. This internal furrow obviously corresponds to a median keel of the preceding volution.

Dimensions.

Diameter of the shell	37 mm.
„ „ „ umbilicus	18 „
Height } of the last volution	10 „
Thickness } of the last volution	17 5 „

Sutures.—The complete sutural line with the antisiphonal lobe has been studied in the fragment illustrated in Pl. I, fig. 7.

The sutures are similar to those of *Margarites Jokelyi* Hauer The siphonal lobe is the deepest and is divided by a low median prominence into two sharp points diverging towards the siphonal saddles on both sides. A few accessory indentations follow along the basal margin of the siphonal saddle The lateral lobe is very broad and terminates in five digitations, the central one being deepest. Each of the three larger denticulations is provided with serrated margins. This lobe is divided by the siphonal margin, which passes through the central denticulation. The umbilical lobe stands at the same level as the lateral lobe, but is narrow and has a trifid termination. The large external and the smaller lateral saddles are brachyphyllic and serrated up to their tops, although less markedly so than in *M. Jokelyi.*

The series of internal lobes begins with a broad, deeply incised saddle, corresponding to the umbilical saddle in *M. Jokelyi*, and terminates with a high and slender antisiphonal saddle. Between the two antisiphonal saddles a bicuspidate lobe is enclosed.

The antisiphonal lobe and saddles are a diminished copy of the siphonal lobe and saddles and in their dimensions not inferior to the lateral elements of the sutural line.

Locality.—Number of specimens examined.—Kalapani 1, coll. Smith; Tera Gádh 1, coll. Krafft.

B. Group of *Margarites unispinosi.*

5. MARGARITES GEORGII v. Mojsisovics. Pl. III, fig. 8.

1893. *Margarites Georgii* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI·2, p. 309, Taf. CXIX, fig. 9.

The specimen figured from the Tropites-limestone of Kalapani (coll. Smith) agrees in every respect with the type-specimen of *Margarites Georgii* from the Subbullatus-beds of Aussee. Even in the most subordinate details there is a complete agreement between the two examples. Such details are: the more evolute spiral of the last whorl, which does not touch the marginal spines, the somewhat concave shape of the lateral ribs, their obliteration in the vicinity of the umbilical suture, the presence of short external ribs originating in pairs from the marginal spines, and of deep furrows bordering the smooth median keel.

Dimensions.

Diameter of the shell	29	mm.
,, ,, ,, umbilicus	15	,,
Height } of the last volution	7	,,
Thickness } of the last volution	10·5	,,

Sutures.—Not known.

6. MARGARITES sp. ind. ex aff. GEORGII Mojs. Pl. III, fig. 9.

This species represented by a single incomplete specimen from the Tropites-limestone of Kalapani (coll. Smith), is very nearly allied to *Margarites Georgii*. Mojs., from which it differs chiefly by its broad and flattened external area and by the shape of its cross-section, which is nearly twice as wide as high.

The lateral sculpture is absolutely identical, but the ornamentation of the siphonal area is more strongly marked. It consists of ribs originating from the marginal spines and of intercalated ribs, both of them touching the median keel-furrows.

Dimensions.—The measurements have been taken along the transverse section caused by the fracture of the specimen.

Diameter of the shell		33 mm.
„ „ „ umbilicus		18 „
Height	of the last volution	7·5 „
Thickness		13·5 „

Sutures.—Not known in detail.

7. MARGARITES DEVASENA nov. sp. Pl. III, fig. 10.

This is the most remarkable species among the Himálayan representatives of the genus *Margarites*.

It is distinguished by its very low and slowly increasing whorls, its broad external area and its strong, elongated marginal spines. In its general shape it recalls *Margarites Jokelyi* Hauer, although Indian specimens of equal size are still lower and wider, but no trace of umbilical spines has been noticed in any of my Himálayan examples, which must consequently be grouped in the section of *M. unispinosi*.

The lateral parts slope from the external edge towards the funnel-shaped umbilicus. An umbilical margin is not distinctly marked even in the body-chamber volution. The flanks are covered with very low, broad and flat ribs, which are well individualized in the vicinity of the marginal spines only, but gradually disappear in the umbilical region. The marginal spines are very strong. If perfectly preserved, they are elongated and sharply pointed, rising vertically above their rounded base. The external area is perfectly flat and almost smooth in the inner volutions. In the last whorl external ribs are developed, their number being twice that of the marginal spines.

Sixteen to eighteen marginal spines are counted in the circumference of the last volution. The keel is low, narrow and smooth, not crenulated, but bordered by broad siphonal furrows.

Dimensions.

Diameter of the shell		30 mm.
„ „ „ umbilicus		17 „
Height	of the last volution	7 „
Thickness		20 „

Sutures.—Not known.

Locality. Number of specimens examined.—Kalapani 3, coll. Smith; Tera Gádh 1, coll. Krafft.

Genus: Tropites Mojsisovics.

1. Tropites subbullatus v. Hauer. Pl. IV, figs. 6, 7.

1849. *Ammonites subbullatus* F. v. Hauer, Über neue Cephalopoden aus den Marmorschichten von Hallstatt und Aussee, Haidinger's Naturwissensch. Abhandl., Bd. III, p. 19, Taf. IV, figs. 1-4 (non. 5-7).

1893. *Troiptes subbullatus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 187, Taf. CVI, figs. 1-3, 5, 7, Taf. CVII, figs. 1-8, Taf. CVIII, figs. 1-6, Taf. CX, fig. 6.

The specimen illustrated in fig. 7, from the Tropites-limestone of Tera Gádh (coll. Krafft) is an adult individual, with a large part of its body-chamber preserved. It agrees completely with F. v. Hauer's type-specimen of *Tropites subbullatus* from the Raschberg near Aussee, illustrated by E. v. Mojsisovics on Pl. CVI, fig. 7 of his Hallstatt monograph.

The last volution is distinguished by a considerable compression, which coincides with the commencement of the widening of the umbilicus. The steeply inclined umbilical wall is exposed up to the beginning of the penultimate whorl only. Umbilical tubercles are but indistinctly developed. The coarse, forward turned ribs are of unequal length and strength, exactly as in F. v. Hauer's type-specimen. They are considerably less broad than in the variety *crasseplicatus*. On the external part they terminate along the low and narrow furrows which accompany the rounded median keel on either side.

The specimen illustrated in fig. 6 is a young individual, agreeing in its specific characters with the examples illustrated by E. v. Mojsisovics on Pl. CVII, figs. 5 and 6. It exhibits the deep funnel-shaped umbilicus, with its steeply but evenly inclined plane, encircled by the spiral of closely-set, small tubercles from which the transverse ribs originate. The external area is partly covered with its shelly substance, but the umbilical region of the cast is entirely devoid of it. It is consequently smooth and does not show the ribbing within the umbilical plane as distinctly as the perfectly preserved types illustrated by E. v. Mojsisovics.

Dimensions.

	Adult specimen, Fig. 7.	Inner nucleus, Fig. 6.
Diameter of the shell	cca. 70 mm.	36 mm.
" " umbilicus	21 "	17 "
Height } of the last volution	31 "	12 "
Thickness } of the last volution	31 "	24 "
Thickness of the penultimate whorl	36 "	17 "

Sutures.—Not known.

2. Tropites cf. fusobullatus Mojsisovics. Pl. V, fig. 3.

1893. *Tropites fusobullatus* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 194, Taf. CIX, figs. 1-3.

1896. *Tropites ind. cf. fusobullatus* v. Mojsisovics, Denkschr. Kais. Akad. d. Wissensch. math. nat. Cl., Bd. LXIII, p. 613, Taf. XI, fig. 5.

1899. *T. f. ind. cf. fusobullatus* v. Mojsisovics, Palæontologia Indica, ser. XV, Himál. Foss., Vol. III. pt. 1, p. 47. Pl. XI, fig. 5.

Some more or less damaged and deformed fragments in Griesbach's collections from Kalapani were provisionally referred to this species as *cf.* by E. v. Mojsisovics. Among the materials collected at the same locality by Smith, there is one single cast, which I refer with some hesitation and reserve to *Tropites fusobullatus.* It does not agree with the typical form illustrated by E. v. Mojsisovics in figs. 1 and 2 of the Hallstatt monograph (Pl. CIX), and I should not have ventured on a direct identification with *T. fusobullatus* without having the specimen from the Raschberg, illustrated in fig. 3, at hand for comparison. But with this example there is indeed, a very close agreement in shape, dimensions and sculpture.

The whorls are very thick, nearly three times as wide as high, and are provided with distinct umbilical tubercles. Of such tubercles very few only are seen in the last volution, since the umbilical edge has been much injured, but those are rounded and coarse tubercles of considerably larger size than in the preceding species

The contact of the volutions takes place outside the umbilical tubercles. Within the funnel-shaped umbilicus the tubercles are exposed along a spiral, which can be followed down to the innermost volutions, but in consequence of the smaller size of my specimen, the distance between the spirals of involution and of the umbilical tubercles is considerably smaller than in the two full-grown type-specimens of *T. fusobullatus* from the Raschberg.

As my specimen is a cast devoid of its shell, the presence of longitudinal striæ cannot be ascertained, although there are some indistinct traces of a longitudinal ornamentation on the umbilical wall. Bifurcating ribs are seen originating from the umbilical tubercles, alternating occasionally with single, undivided ribs. The steeply inclined umbilical wall is also covered with numerous strong, undivided ribs.

The keel on the external part is accompanied by deep, rounded keel-furrows.

My specimen is an inner nucleus, like the examples collected by Griesbach and examined by E. v. Mojsisovics, and not an adult individual. This is proved by the thickness of its last volution, which is still very considerable, whereas in the body-chamber of full-grown specimens the width of the cross-section gradually diminishes towards the aperture.

Dimensions.

Diameter of the shell	44 mm.
„ „ „ umbilicus	20 „
Height } of the last volution	18 „
Thickness } of the last volution	36 „

Sutures.—E. v. Mojsisovics describes the sutural line of the Himálayan specimens collected by Griesbach as "agreeing with the typical sutures of the bullate *Tropites*" apart from their being somewhat deformed through the distortion of the specimens. I have not succeeded in developing the sutural line of my specimen.

3. TROPITES cf. DISCOBULLATUS Mojsisovics. Pl. IV, fig. 1.

1893. *Tropites discobullatus* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 212, Taf. CII, figs. 7, 8; CIV, figs. 1-6; CV, figs. 2, 3, 4, 7.

1896. *Tropites cf. discobullatus* E. v. Mojsisovics, Denkschr. Kais. Akad. d. Wiss. math. nat. Cl., Bd. LXIII, p. 613, Taf. XI, fig. 7.

1899. *T. f. ind. cf. discobullatus* E. v. Mojsisovics, Palæontologia Indica, Himál. Foss., ser. XV, Vol. III, pt. 1, p. 78, Pl. XI, fig. 7.

In Griesbach's collection from Kalapani a fragment not sufficient for an exact determination was noticed by E. v. Mojsisovics and referred with some reserve to the group of varieties of *Tropites discobullatus*. A very large and perfectly preserved specimen of a *Tropites* very closely allied to *Tropites discobullatus* from the same locality (coll. Smith) lies before me, but it is not possible to establish the identity of the Indian fossil with the European species with full certainty, on account of some small differences in the shape of the keel and keel-furrows.

Notwithstanding its large dimensions my specimen is not complete. The last sutural line is clearly visible at the end of the posterior third part of the last whorl. Thus at least one half a volution must be added to this whorl in order to complete the entire shell.

It appears as if the last whorl had been broken off a short distance from the point at which the widening of the umbilicus begins.

Near the aperture the thickness of the cross-section is still greater than that of the penultimate whorl. The sharp umbilical edge rises considerably beyond the spiral of involution. This proportion is the usual one in inner nuclei and small individuals of *Tropites discobullatus*, but not in full-grown specimens. Our specimen might therefore be considered as a variety, in which some features characteristic of the adolescent age have been retained in later stages of growth. In this respect it approaches most nearly the specimen from the Raschberg illustrated by E. v. Mojsisovics on Pl. CII, fig. 7, of the Hallstatt monograph.

The arrangement and curvature of the ribs are the same in the Indian as in the European form. The keel is bordered by deep and rounded keel-furrows, each of them accompanied along its marginal side by a spiral edge, resulting from a conjugation of lateral ribs. In this character of the keel my Indian specimen differs from the Alpine types of *Tropites discobullatus*. It is on account of this difference, that I have not ventured on a direct identification, although E. v. Mojsisovics did not lay any stress on this feature, which is also noticed in the specimen from Kalapani collected by C. L. Griesbach

Dimensions.

Diameter of the shell		76 mm.
" " " umbilicus		23 "
Height of the last volution	above the umbilical suture	31 "
	" " preceding whorl	20 "
Thickness of the last volution		37 "

Sutures.—The sutures are very similar to those of *T. discobullatus*, as illustrated by E. v. Mojsisovics on Pl. CV, fig. 2, although the incisions of the siphonal saddle are less deep and complicated. But in the relative height of the siphonal and lateral saddles my specimen agrees with *T. discobullatus*, not with *T. subbullatus*. A second lateral saddle and a large auxiliary saddle stand outside the umbilical suture.

4. TROPITES cf. ESTELLÆ Mojsisovics. Pl. IV, fig. 3.

1893. *Tropites Estellæ* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 193, Taf. C.V. figs., 5, 6.

A single and somewhat fragmentary specimen from Kalapani (coll. Smith) agrees very closely with the type-specimen of *Tropites Estellæ*. The opening of the umbilicus begins at an earlier stage of growth than in *Tropites subbullatus*, the lateral parts being exposed within the umbilicus outside the spiral of involution at least up to the commencement of the penultimate whorl. I have not succeeded in clearing the inner portion of the umbilicus from the adhering matrix. My specimen is of discoidal shape, showing a very great resemblance to *T. Estellæ* in this respect, and is considerably less globose than examples of *T. subbullatus* of corresponding size.

The sculpture consists of bifurcating ribs of very different strength and width. The ribs either rise in pairs at the umbilical edge or else bifurcate at the middle of the lateral parts. Some ribs are acute in the umbilical region, but broaden out on the external part.

Umbilical tubercles are distinctly developed as far as the beginning of the last volution only. The external part is crossed by the broad and flattened ribs, the low keel playing only an insignificant part in its ornamentation.

Dimensions.

Diameter of the shell	65 mm.
„ „ „ umbilicus	26 „
Height } of the last volution	21 „
Thickness } of the last volution	25 „
Thickness of the penultimate whorl	26 „

Sutures.—Not known.

5. TROPITES MANASA nov. sp. Pl. IV, fig. 2.

This species, represented by a single, but fairly well-preserved specimen from Kalapani (coll. Smith) is related to *Tropites Estellæ* Mojsisovics.

The widening of the umbilicus begins at an earlier stage of growth than in *T. subbullatus* Hauer, and is very considerable. The lateral parts of the penultimate whorl are exposed almost entirely within the umbilicus outside the spiral of involution. The compression of the body-chamber whorl is more marked than in any other species of *Tropites*. The difference in shape between the inner nucleus and the adult individual is therefore more conspicuous than in *T. Estellæ* or in *T. subbullatus.* The cross-section of the penultimate whorl of *T. Manasa* does not differ from that of an inner nucleus of those two species, but the last volution becomes high-mouthed, provided with flattened lateral parts and even with a flat siphonal area, which passes into the flanks with a steeply rounded curve.

Another feature of distinction between this species and its nearest congeneric allies consists in the shape of the keel-furrows. The keel-furrows, which border a sharp, narrow and comparatively low, median keel on either side, are deep and broad, with a rounded base, and accompanied by strongly elevated, continuous marginal edges. Those edges are not formed by conjugation of the ribs, resulting from the ribs uniting with their terminations along the keel-furrow, but are a spiral element of ornamentation independent of the ribs, which meet the edges in acute angles.

The umbilical edge of the penultimate whorl is adorned with numerous, close-set tubercles, from which lateral ribs originate either singly or in pairs. In the last volution umbilical tubercles are absent. Most of the ribs are undivided, but occasionally a bifurcation is noticed in the vicinity of the siphonal margin. Intercalation of ribs is quite an exception.

Dimensions.

Diameter of the shell		68 mm.
,, ,, ,, umbilicus		29 ,,
Height	of the last volution	22 ,,
Thickness		19·5 ,,
Height	of the penultimate whorl	15 ,
Thickness		23 ,,

Sutures.—Not known.

6. Tropites cf. Paracelsi Mojsisovics. Pl. IV, fig. 5.

1893. *Tropites Paracelsi* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. k. Geol. Reichsanst., VI-2, p. 191, Taf. CXCVI, fig. 5.

A single but well-preserved specimen from Kalapani (coll. Smith) seems to be most closely related to *Tropites Paracelsi* Mojsisovics, from which it differs only by very subordinate details of its ornamentation.

The chief character of *Tropites Paracelsi*—the shallow umbilicus with its moderately inclined walls—is also most distinctly developed in my type-specimen. As in *Tropites subbullatus* the involution of the whorls takes place immediately outside the spiral line of umbilical tubercles, which are therefore seen within the umbilicus firmly appressed to the umbilical wall of the following whorl. With the commencement of the body-chamber, however, the umbilicus begins to widen out gradually, the umbilical wall becomes steep and the distance between the umbilical edge of the penultimate, and the umbilical suture of the last, volution increases considerably.

In the present specimen exactly one-half of the last volution belongs to the body-chamber, the larger portion of which must consequently have been broken off.

The compression of the whorl coinciding with the umbilical opening can scarcely have been smaller than in the type-specimen illustrated by E. v. Mojsisovics, as it is already clearly marked in the aperture of my Himálayan example, although this aperture must be situated at least one-half of a volution behind the actual peristome of the shell.

The sculpture agrees in its general arrangement with that of *Tropites Paracelsi.* The umbilical edge is provided with strong tubercles. From each tubercle a single rib as a rule originates and is separated from the adjoining ribs by broad intercostal spaces. From the umbilical tubercles the ribs are turned forward towards the aperture, describing a very flat curve. They are continued beyond the umbilical tubercles along the umbilical wall, reaching down into the umbilical funnel, turning in a backward direction Thus a sharp angle in the direction of ribs is marked by the umbilical tubercles.

Most of the ribs are undivided. Bifurcations occur rather rarely, either in the umbilical or in the marginal regions. In this respect the two halves of the shell are not perfectly symmetrical. In the type-specimen illustrated by E. v. Mojsisovics a corresponding asymmetry has also been noticed.

The only difference between the ornamentation of the Indian and that of the European examples consists in the smaller number of ribs and the proportionately wider intercostal spaces which distinguish our Indian type. This difference is too insignificant to justify the introduction of a new specific denomination for the specimen from Kalapani.

Dimensions.

Diameter of the shell		51 mm.
" " " umbilicus		27 "
Height	of the last volution	15 "
Thickness	of the last volution	21 "
Height	of the penultimate whorl	10 "
Thickness	of the penultimate whorl	22 "

Sutures.—The sutural line of *Tropites Paracelsi* was not known to E. v. Mojsisovics. In my specimen the sutures of the four last air-chambers are clearly visible.

As the lateral saddle touches the umbilical tubercles with its inner margin, the presence of the normal number of sutural elements is rather doubtful. It was impossible to ascertain, whether the small lobe coinciding with the umbilical margin should be considered as second lateral, or rather as first auxiliary, lobe. The two main saddles are dolichophyllic and of rather unequal size, the siphonal saddle being considerably larger than the lateral. A third small saddle is situated on the umbilical wall.

7. TROPITES JALANDHARA nov. sp. Pl. IV, fig. 4.

This species represented in Smith's collections from Kalapani by the specimen illustrated, recalls in its general shape and involution *Tropites Paracelsi* Mojsisovics.

Only one quarter of the last volution belongs to the body-chamber. The complete body-chamber volution being unknown, it is impossible to decide whether the species is really allied to *T. Paracelsi* or should more properly be referred to *T. Aesculapii* v. Mojsisovics (l. c., p. 208, Taf. CXI, fig. 2), which is distinguished by the absence of any compression of the last whorl.

The umbilicus is wide and comparatively shallow, exactly as in *T. Paracelsi*. The widening of the umbilicus begins at an early stage of growth, near the commencement of the penultimate whorl. The attachment of the inner volutions takes place at the umbilical margin. In the penultimate whorl the umbilical tubercles are left outside the spiral of involution.

In its sculpture the present species shows a greater resemblance to *Tropites Telleri* Mojsisovics (l. c. p. 201, Taf. CXI, figs. 6—9, Taf. CXII, figs. 3, 4) than to *T. Paracelsi*. It is distinguished from this and from all congeneric forms by the large number of intercalated lateral ribs. As in *T. Telleri* ribs originate in pairs from strong umbilical tubercles, which, however, are not so close to one another as in the European species. The ribs are turned forward describing a very flat curve. Secondary bifurcations occur but rarely and irregularly in the external region. Between two pairs of ribs originating from umbilical tubercles one or two ribs, either single or dichotomous, are intercalated, and extend from the umbilical margin to the keel-furrows. Thus the number of ribs touching the external keel-furrows is three to four times as great as the number of umbilical tubercles, and not, as in *Tropites Telleri*, merely twice as great.

Dimensions.

Diameter of the shell	53 mm
„ „ „ umbilicus	26 „
Height } of the last volution	16·5 „
Thickness } of the last volution	18 „

Sutures.—Not known.

8. TROPITES sp. ind. aff. ACUTANGULO Mojs.

1896. *Tropites nov. form. ind. cf. acutangulus*, E. v. Mojsisovics, Denkschr Kais. Akad. d Wissensch., Wien, math. nat Cl. Bd. LXIII, p. 612, Taf. XI, fig. 4.

1899. *Tropites nov. f. ind. cf. acutangulus*, E. v. Mojsisovics, Palæont. Indica, ser. XV. Himál. Foss., Vol III, Pt. 1, p. 46, Pl. XI, fig. 4.

This species from the group of *Tropites acutangulus*, E. v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2 p. 203, Taf. CXII, figs. 1, 2) is represented among Smith's materials from Kalapani by a single specimen, closely agreeing in its shape and sculpture with the type figured by E. v. Mojsisovics. It is of smaller size and has suffered somewhat less by distortion. As it is neither especially well preserved nor distinguished from the type-specimen by any remarkable feature, I have not deemed it worthy of a special illustration.

9. TROPITES WODANI E. v. Mojsisovics. Pl. V, fig. 6.

1893 *Tropites Wodani* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 221, Taf. CXVI, fig. 6.

A comparison of the figured specimen from Kalapani (coll. Smith) with two specimens of *Tropites Wodani* from the Ellipticus-beds of Aussee has induced me to venture on a direct identification. My Himálayan specimen is of somewhat larger dimensions, but shows in its shape, involution and sculpture the closest agreement with the Alpine type illustrated by E. v. Mojsisovics.

The slowly increasing volutions are of equal height and width and enclose a comparatively narrow umbilicus, which is surrounded by a high and vertical umbilical wall. The body-chamber volution does not differ in its shape and sculpture from the preceding whorls.

The sculpture consists of numerous acute and narrow ribs, which originate in pairs from transversely elongated umbilical tubercles. A second bifurcation is occasionally noticed. Intercalated ribs are also developed, but rather rarely and irregularly. The intercostal valleys are considerably broader than the acute ribs. This character has not been reproduced satisfactorily in the illustration given by E. v. Mojsisovics.

In the external region the ribs diminish in strength, but all extend up to the median keel. Near the aperture the ornamentation becomes more delicate but is not subject to any marked variation. The high and sharp median keel is bordered only by very low external furrows.

Dimensions.

Diameter of the shell	38 mm.
„ „ „ umbilicus	9 „
Height of the last volution	13 „
Thickness of the last volution	14 „

Sutures.—Not known.

10. TROPITES KALAPANICUS Mojsisovics.

1896 *Tropites Kalapanicus* E. v. Mojsisovics, Denkschriften Kais. Akad. d. Wissensch, Wien, math. nat. Cl Bd. LXIII, p. 611, Taf. XI, fig. 8.

1899. *T. Kalapanicus* E. v. Mojsisovics, Palæont. Indica, XV, Himál. Foss. Vol. III, Pt. 1, p. 45, Pl. XI, fig 8.

E. v. Mojsisovics has hinted at the resemblance that this species bears to the subgenus *Paratropites* in some of its external features.

My materials are too scanty to add anything to his description. It is, however, interesting to state that the species is also represented in A. v. Krafft's collections from the Tropites-limestone of Lilinthi.

Subgenus: *ANATROPITES* Mojsisovics.

1. ANATROPITES NIHALENSIS nov. sp. Pl. IV, figs. 8, 9.

The specimen illustrated in fig. 9, with its shell partly preserved, is to be regarded as the type of this species. The determination of the systematic position of the present form offers not inconsiderable difficulties, on account of its great individual variability and of the indistinctly defined characters of the subgenus *Anatropites*.

The type-specimen from Nihal (coll. Smith) seems to be nearly allied to *Anatropites Adalgi* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 225, Taf. CX, fig. 3) from the carnic Hallstatt limestone of Aussee. Its obliquely elliptical outline is not a feature of specific value but is due to distortion. This can be ascertained by the presence of a specimen with the normal spiral of involution among my materials from Nihal.

The slowly increasing volutions are nearly twice as broad as high. In the body-chamber whorl (fig. 8) the height increases considerably in proportion to the width. The umbilicus of the inner volutions is funnel-shaped, but the last volution is provided with a comparatively high and steep umbilical wall.

The sculpture is very prominent and consists of acute, forward-curved ribs, which rise in pairs from stout umbilical tubercles. As a rule cicatrices only have been preserved, but from the presence of a very small number of spines that have been preserved, it may be assumed that in reality the umbilical margin was adorned with high, pointed spines. For this reason I have deemed it preferable to class the present species with the subgenus *Anatropites* rather than with *Tropites* (*sensu stricto*). The reference of *Tropites Adalgi* Mojs. to the group of *Tropites spinosi* (*Anatropites*) was, indeed, based on the examination of a specimen with spines in no better state of preservation than those of my type-specimen of *A. nihalensis*.

In the type-specimen illustrated in fig. 8, the spines or rather the cicatrices, which have been left, are the predominant element of sculpture. This is not the case in the variety illustrated in fig. 9. There the sharp and prominent ribs are more strongly developed than the spines, especially so in the body-chamber volution. But the arrangement of the ribs is exactly the same as in my type-specimen. As the two types are connected moreover by transitional forms, I have united them in one single species, but must confess that in the variety the subgeneric features of *Anatropites* are but very faintly marked and had the type illustrated in fig. 8 not been avialable for examination no reason could have been brought forward in favour of placing our species among this subgenus.

The sharp and narrow keel is elevated considerably above the general convexity of the external part, but accompanied by very low, indistinct keel-furrows only.

Dimensions.

	Fig. 8.	Fig. 9.
Diameter of the shell	33·5 mm.	24 mm.
„ „ „ umbilicus	9·5 „	9 „
Height of the last volution	18 „	7·5 „
Thickness of the last volution	14 „	15 „

Sutures—Not known.

Locality. Number of specimens examined.—Nihal 4, coll. Smith; Kalapani 3, coll. Smith.

2. ANATROPITES MARGARITIFORMIS nov. sp. Pl. II, fig. 13.

In the Tropites-limestone of Kalapani this species is represented by a single, but fairly well-preserved, specimen. Its affinity to the Alpine species of the group of *Tropites spinosi* (subgenus *Anatropites*) is rather distant. Its most prominent feature is the presence of very large and coarse umbilical tubercles, of which cicatrices only have been preserved in the last volution, but which in their perfect state of preservation, were probably elevated into high and sharp thorns, recalling the marginal spines in *Margarites Jokelyi* Hauer.

The slowly increasing whorls overlap one another up to the umbilical spines which are clearly exhibited within the umbilicus of the penultimate whorl. From those spines the umbilical wall slopes down to the umbilical suture in a steeply rounded curve, but is gradually developed into a high and perpendicular wall in the last volution, where it is separated from the lateral parts by a distinctly marked, bluntly rounded edge.

The full-grown specimen exhibits a remarkable similarity with some species of the group of *Margarites unispinosi*, but the spines are truly umbilical, not marginal as in *Margarites*. This is clearly seen in the last volution, where the flattened lateral parts become gradually individualized from the rounded external part.

The umbilicus is deep and funnel-shaped, but opens out slightly near the end of the last volution. The keel is moderately high, sharp and smooth and bordered by very low keel-furrows.

In the last volution coarse, bifurcating ribs originate from the umbilical tubercles. Single undivided ribs are occasionally intercalated between them. A second bifurcation occurs only rarely in the marginal region of the shell. The ribs reach across the rounded external part as far as the median keel-furrows.

Dimensions.

Diameter of the shell	43 mm.
„ „ „ umbilicus	13 „
Height of the last volution above the umbilical suture	18 „
Height of the last volution „ „ preceding whorl	12 „
Thickness of the last volution	21 „

Sutures.—Not known.

Subgenus: *PARATROPITES* Mojsisovics.

PARATROPITES (?) LILINTHICUS nov. sp. Pl. X, fig. 6.

This species is represented by a single small specimen from the Tropites-limestone of Lilinthi, with part of its body-chamber preserved. It shows close affinities to *Eutomoceras* as well as to *Paratropites* and I must leave its generic position doubftul.

The volutions are less strongly compressed and broader than in the majority of species belonging to the genus *Eutomoceras*. The only group which is distinguished by cross-sections of equal width is that of *E. sulcatum* Calc. and *E. Wöhrmanni* Gemmellaro from the Triassic limestone of Sicily (I cefalopodi del Trias superiore della parte occidentale della Sicilia p. 80, Taf. VIII, figs. 1-4; XIX, fig. 14, and p. 15; Taf. XIX, figs.12, 13). The greatest transverse diameter coincides with the sharp umbilical edge. From this edge the lateral parts converge without any convexity towards the siphonal margin. The siphonal margin is rounded at the beginning of the last volution, but forms a blunt edge in the vicinity of the aperture. The siphonal area is broad, flattened and provided with a median keel accompanied by low keel-furrows on either side. The umbilicus is deep, narrow and surrounded by a perpendicular wall.

The ornamentation is very delicate. Indistinct ribs run from the umbilical to the external margin in an almost straight direction, being turned slightly forward near the marginal edge only. Some of them bifurcate in the middle of the flanks, where a delicate spiral line is noticeable.

Dimensions.

Diameter of the shell	25 mm.
" " " umbilicus	2·5 "
Height of the last volution { above the umbilical suture	18·5 "
" " preceding whorl	9·5 "
Thickness of the last volution	10 "

Sutures.—The sutural line exhibits a dolichophyllic development, with very slender saddles.

The siphonal lobe is short, divided by a broad median prominence and terminates in a single, sharp point in each wing. The principal lateral lobe is the deepest and terminates in a long digitation. The second lateral saddle is bifid and divided at its base by a large indentation. The siphonal saddle exceeds the principal lateral saddle in height and width. The second lateral saddle is well individualized and distinctly marked off from the auxiliary series, which is not known to me in detail.

Remarks.—The systematic position of the present species is doubtful. On account of its outward similarity to the group of *Tropites aequabilis* (*Paratropites*) one might be in doubt whether to refer it to *Eutomoceras* or to *Paratropites.*

The reasons which induced me to give preference to the latter alternative are:—(1) The flattened character of the lateral parts, which are as distinctly separated from the siphonal area as in *Paratropites Phœnix* Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-2, p. 248, Taf. CXV, fig. 13; CXVI, figs. 2-5); (2) the very delicate sculpture, in which spiral striations play an insignificant part; (3) the agreement in the character of the sutural line with *Paratropites Phœnix* Mojs. and *P. Anacreontis* Mojs.

On the other hand it must be said that the occurrence of a spiral line in the middle of the flanks is a feature which is not known in Alpine species of *Paratropites*, and that inner nuclei of *Eutomoceras* are so closely related with *P. Phœnix* as to be almost indistinguishable from that species. E. v. Mojsisovics himself emphasizes this fact and remarks that the only character of distinction between *P. Phœnix* and young specimens of the group of *Eutomocerata striata* is the presence of a hollow, funnel-shaped keel in *Eutomoceras*. This character is practically useless, as it can be determined only when rich material is available for examination.

The question, whether or not it is correct to assign the present species to *Paratropites*, must consequently be left in suspense.

Family: *CELTITIDAE* Mojs.

Genus: Tropiceltites Mojsisovics.

Tropiceltites arietitoides nov. sp. Pl. III, fig. 12

Had the specimen figured been found in beds of liassic age, nobody, I believe, would have hesitated to identify it with a species of the genus *Arietites* Waagen. *Ammonites longidomus* Quenstedt (Die Ammoniten des schwäbischen Jura, I, p. 50, Taf. VI figs. 1, 2) from the lower lias of Würtemberg recalls very strongly our species. Although instances of convergency between ammonites of upper Triassic and Jurassic age are not rare (*Celtites-Psiloceras*, *Tropites-Pseudotropites*, *Sibirites-Peltoceras*) this is certainly the most remarkable case known to me.

My species is represented in the Himalayan collection by the specimen illustrated and by a small number of fragmentary examples, all from Kalapani (coll. Smith). The type-specimen is a flat, discoidal shell, with a widely open umbilicus. The numerous and slowly increasing whorls overlap one another along the external part only. A high and sharp, smooth keel is bordered on either side by deep, rounded furrows. This keel is acquired at quite an early stage of growth. An examination of the cross-section shows that it is distinctly developed in a stage corresponding to a diameter of the shell of 13 mm. The siphonal area is regularly vaulted and passes into the flattened lateral parts without any marginal demarcation. A steep umbilical wall is developed in the two last volutions, but there is no umbilical edge. In the inner whorls the lateral parts slope towards the umbilical suture in a regular curve, which gradually increases in steepness.

The sculpture of the inner whorls, as far as they are exposed within the wide umbilicus, consists of sharp lateral ribs separated by wider intercostal spaces. About 35 ribs are counted in the circumference of the penultimate whorl. They are most prominent in the umbilical region. In the marginal region of the last volution they become faint and bend forward to the keel-furrow in a sharp angle. In this region they are intersected by a small number of longitudinal striæ. This spiral ornamentation is restricted to the external part of the shell.

On the flanks the direction of the ribs is not quite radial but slightly curved, with the convexity turned backward, as in *Arietites longidomus.*

Dimensions.

Diameter of the shell		69 mm.
" " " umbilicus		37 "
Height of the last volution	above the umbilical suture	16·5 "
	" " preceding whorl	14 "
Thickness of the last volution		15 "

Sutures.—The sutural line is only partially known to me, but what is exposed of it along the flanks of the penultimate whorl is sufficient to exclude any possibility of uniting our species with the genus *Arietites.*

A ceratitic lateral lobe is followed by a slender saddle, the margins of which are either faintly serrated or entire. A second lobe is noticed on the umbilical wall. At least one entire volution belongs to the body-chamber.

Remarks.—The only genus in which the present species can be placed is *Tropiceltites,* of carnic and noric age. There are, indeed, some species of the group of *Tropiceltites arietitiformis* from the Hallstatt limestone, which show a remarkable similarity, *e. g.*, *Tropiceltites arietitiformis* Mojsisovics (Cephalopoden der Hallstätter Kalke, l. c., VI-2, p. 385, Taf. CXXI, figs. 39-40) or *T. minimus* Mojs. (*ibidem,* p 385, Taf. CXXI, fig. 12). But all the Alpine representatives of the genus are dwarf species, which do not exceed 25 mm. in diameter. Thus the present species certainly holds an isolated position among its congeneric forms.

The opinion might be expressed, that the presence of ceratitic sutures points to a species different from *Tropiceltites,* which according to the diagnosis given by E. v. Mojsisovics is provided with clydonitic sutures only. It must, however, be remembered, that in the whole group of *T. arietitiformis* there is not one single species the sutures of which have really been examined.

A species which is perhaps more nearly allied to the present one than any of the Alpine forms, is *Anatropites Mojsisovicsi* Gemmellaro (I cefalopodi del Trias superiore della Sicilia, p. 123, Taf. VII, figs. 40-42) from the Triassic beds of Feudo Votano in Sicily. The lateral sculpture is of nearly the same pattern but a remarkable difference consists in the absence of any deep keel-furrows in the species from the Trias of Sicily. I cannot understand on what grounds this species has been grouped by Gemmellaro with the subgenus *Anatropites*. In this subgenus E. v. Mojsisovics has united such species as are distinguished by the presence of strong umbilical spines, at least in adolescent stages of growth. Now there is not the least trace of spines in the sculpture of the Sicilian species, which might justify its being put in the group of *Tropites spinosi*. If its reference to *Tropites* should be proved to be correct, it would probably find its proper place with the group of *Tropites aequabiles* (subgenus *Paratropites*).

Family: *DIDYMITIDÆ* Mojs.

Genus: DIDYMITES Mojsisovics.

1. DIDYMITES TECTUS v. Mojsisovics. Pl. XII, figs. 4, 5.

1873. *Didymites tectus* E. v Mojsisovics, Das Gebirge um Hallstatt, Abhandl. K. K. Geol Reichsanst. VI-1, p. 153, Taf. LIX, figs. 3, 4; LX, fig. 6.
1902. *D. tectus* v. Mojsisovics, *ibidem*, Supplementband, p. 334.

I should not have ventured on a direct identification of my Himálayan specimens from the Tropites-limestone of Kalapani, Lilinthi, and Tera Gádh with this European species had I not been able to compare them with numerous Alpine examples which were determined by E. v. Mojsisovics himself.

The Indian examples are, in general, of smaller size than most of the Alpine specimens. There are, however, among my Indian materials some shells (*e.g.*, the specimen illustrated in fig. 4), which are equal in their dimensions to average-sized examples from the noric Hallstatt limestone of the Vorder Sandling (zone of *Cyrtopleurites bicrenatus*).

The figured specimens agree so closely with the European types of the species in shape and ornamentation that a description of them is unnecessary.

Dimensions.

	Fig. 4.	Fig. 5.
Diameter of the shell	29 mm.	24 mm.
,, ,, ,, umbilicus	2·5 ,,	2 ,,
Height of the last volution { above the umbilical suture	16 ,,	12 ,,
,, ,, preceding whorl	5 ,,	4 ,,
Thickness of the last volution	22·5 ,,	15 ,,

The specimen illustrated in fig. 5, is provided with its peristome. The apertural margin is falciform, following in its outlines the direction of the transverse striæ of growth. The siphonal part is somewhat flattened and contracted behind the expanding aperture. This character has not been accurately represented in the figure.

Sutures.—Agreeing with those of the Alpine types of ***Didymites tectus***.

Siphonal and principal lateral lobes equally deep. Siphonal lobe narrow, divided by an entire median prominence, terminating with a single sharp point in each wing. Three dimeroid saddles, which are serrated up to their tops. A small, rounded umbilical saddle corresponds with the umbilical suture.

The illustration in E. v. Mojsisovics' monograph does not represent the sutural line beyond the third bipartite saddle.

Locality.—Number of specimens examined.—The species is very common in the Tropites-limestone of Kalapani, Tera Gádh, and Lilinthi. Some slabs of rock are crowded with examples occurring together with *Arcestidæ*. The outward similarity between *Didymites tectus* and inner nuclei of *Arcestes* renders a safe determination difficult, without examining the sutural lines, an examination, which in examples with body-chambers, can only be effected after having destroyed the last volution. In this way the determination of more than twenty specimens from the three above-quoted localities has been made secure.

2. DIDYMITES sp. ind. aff. QUENSTEDTI Mojs. Pl. XII, fig. 7.

The figured specimen from the Tropites-limestone of Kalapani (coll. Krafft) has been referred provisionally to a species of the group of *Didymites Quenstedti* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 154, Taf. LIX, fig. 5; LX, fig. 8), on account of its compressed volutions and of the similarity of the cross-section.

Otherwise a comparison between my Himálayan and the European type-specimen of *Didymites Quenstedti* from the noric Hallstatt limestone of the Sommeraukogel is rather dfficult. The latter is of very large size, reaching a diameter of 52 mm., whereas my Indian example is not larger than the majority of the Indian representatives of *D. tectus*, although it is provided with a part of its body-chamber. This great difference in size excludes any direct identification.

In shape, transverse section and ornamentation, the present specimen closely agrees with *Didymites Quenstedti*. The bundling of the striæ in the last volution, which has been noticed by E. v. Mojsisovics in his Hallstatt type, is also distinctly marked, especially where the shell has been preserved.

Dimensions—Not measurable.

Sutures.—Of the sutural line only the siphonal saddle and lobe and part of the lateral lobe are known to me. The siphonal saddle shows the dimeroid development, which is the chief character of generic importance in *Didymites*. It is serrated up to its top.

3. DIDYMITES sp. ind. ex. aff. D. SUBGLOBUS Mojs. Pl. XII, fig. 6.

A chambered nucleus of *Didymites* from the Tropites-limestone of Kalapani (coll. Krafft) agrees in its shape with *Didymites tectus* Mojs., but its last volution is provided with more flatly compressed lateral parts. It must be referred to a new species, on account of deviations in the sutures.

Of the three saddles the first and third only show the characteristic didymitic division, whereas the second saddle is not dimeroid. In this character of the sutural line the present specimen agrees with *Didymites subglobus* v. Mojsisovics (Das Gebirge um Hallstatt, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 152, Taf. LIX, fig. 6; Taf. LX, fig. 9).

Whether our species is closely allied to this European form or even identical, must be left undecided until further discoveries of better preserved specimens are made.

4. DIDYMITES KITCHINI nov. sp. Pl. XII, fig. 15.

This is another species nearly allied to *Didymites subglobus* Mojs., from which it differs by its strongly compressed, lenticular cross-section. There is, indeed, no other species of the genus *Didymites* known to me, in which the volutions are so strongly compressed and high-mouthed.

The only specimen available for examination from the Tropites-limestone of Kalapani (coll. Krafft) consists entirely of chambered whorls, which are higher than broad and overlap one another up to the narrow umbilicus. The lateral parts are moderately inflated and converge towards the narrow, highly rounded siphonal part, from which they are not distinctly marked off. The rate of increase of the volutions is very slow.

In its lenticular cross-section this species recalls some species of *Lobites* (*L. pisum* Muenst., *L. ellipticus* Hauer), but the character of the sutures of course makes distinction easy.

The shell is almost entirely smooth and only covered with indistinct transverse striæ of growth.

As my specimen is chambered throughout, the shape of its body-chamber remains unknown, and its diagnosis must consequently be left incomplete.

Dimensions.

Diameter of the shell	. . . .	20 mm.
" " " umbilicus	. . . .	2 "
Height of the last volution	above the umbilical suture	10·5 "
	" " preceding whorl	3 "
Thickness of the last volution	. . . .	10 "

Sutures—Very similar to those of *Didymites subglobus*. Up to the umbilical margin there are, on the whole, four saddles, all of which, with the single exception of the second saddle, show the characteristic didymitic division. The dimeroid saddles show only a slight brachyphyllic serration. The second saddle is not divided above.

This character of the sutural line points to a very close relationship with *D. subglobus*.

AMMONEA LEIOSTRACA.

A. PINACOCERATOIDEA (LEIOSTRACA BREVIDOMA).

Family: *PINACOCERATIDÆ.*

Genus: PINACOCERAS Mojsisovics.

A. Group of *Pinacoceras parma.*

1. PINACOCERAS PARMA v. Mojsisovics. Pl. XIV, fig. 11.

1873. *Pinacoceras parma* E. v. Mojsisovics, Das Gebirge um Hallstatt, Abhandl. K.|K. Geol. Reichsanst. VI-1, p. 60, Taf. XXVI, fig. 2.
1873. *Pinacoceras subparma* E. v. Mojsisovics, *ibid.* p. 61.
1896. *P. parma* E. v. Mojsisovics, Beitræge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wiss. Bd. LXIII, p. 659, Taf. XVIII, figs. 7, 8.
1899. *P. parma* E. v. Mojsisovics, Upper triassic Cephalopoda-faunæ of the Himálayas, Palæont. Ind. ser. XV, Himál. Foss. Vol. III, Pt. 1, p. 105, Pl. XVIII, figs. 7, 8.
1902. *P. parma* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, l. c. VI-1, Supplementband, p. 294, Taf. XVIII, fig. 1.

The only specimen from the Tropites-limestone of Lilinthi (coll. Krafft) is of moderate dimensions and chambered throughout. In its shape it agrees most closely with the example collected in the Halorites-limestone of the Bambanag section by myself and described by E. v. Mojsisovics. The shell is entirely smooth, extremely narrow, and provided with a sharp, knife-like, external edge.

Dimensions.

Diameter of the shell	88 mm.
,, ,, ,, umbilicus	9·5 ,,
Height of the last volution	46 ,,
Thickness of the last volution	12 ,,

Sutures.—As the distinction of species in the genus *Pinacoceras* has been based by E. v. Mojsisovics almost exclusively on the details of the sutural line, the sutures of our specimen are of chief interest. They are fairly well preserved and agree in almost every respect with those of the specimen from the Halorites-limestone.

There are five adventitious saddles, three main saddles and a long auxiliary series with a doubtful number of elements. The adventitious saddles have dimeroid stems, the main saddles are pyramidal and separated by deep lobes, each of them terminating in a single sharp point. On account of the very small size of the auxiliary lobes and saddles, I cannot say positively if there are more than eight bipartite saddles present or not.

At the base of the first adventitious lobe—corresponding to the siphonal lobe of ammonites with normally arranged sutures—a small secondary saddle is noticed. Our specimen may therefore be safely identified with the variety *sub-parma* Mojs. This feature is also noticed in the specimen from the Haloriteslime-stone, but there the accessory branch of the first adventitious saddle has not yet developed into a proper secondary saddle, as in the present example and in typical representatives of the European variety *sub-parma.*

Pinacoceras parma and its variety *sub-parma* are characteristic types of the lower and middle noric stage of the Hallstatt limestone.

2. PINACOCERAS METTERNICHII v. Hauer (*var.*) Pl. XIII, fig. 1.

1846. *Ammonites Metternichii* F. v. Hauer, *ex parte*, Die Cephalopoden des Salzkammergutes aus der Sammlung des Fursten von Metternich, Wien, W. Braumüller, p. 1, Taf. IV, fig. 4.

1873. *Pinacoceras Metternichii* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 60, Taf. XXVI, fig. 1.

1902. *Pinacoceras Metternichii* E. v. Mojsisovics, ibidem, Supplementbd. p. 295, Taf. XIX, fig. 1.

A specimen of *Pinacoceras* from Tera Gádh (coll. Smith), consisting of air-chambers only, cannot be separated from the famous *P. Metternichii* from the Hallstatt limestone. The characters, by which it differs from E. v. Hauer's type-specimen, are of varietal importance only having been noticed in other specimens from the Steinberg Kogel near Hallstatt.

In its external shape and involution the Himálayan specimen agrees with *Pinacoceras parma* Mojs. and *P. Metternichii* v. Hauer, being provided with discoidal, very high and flat whorls, which overlap one another considerably, and with a narrow umbilicus surrounded by a perpendicular umbilical wall. The specimen is a cast and entirely devoid of its shell. This is the reason for its external part being less sharp than in those examples which are provided with their shells. The narrowly rounded shape of the external part in the transverse section (fig. 16) corresponds to the funnel-shaped enclosure of the inner volutions in *Pinacoceras Metternichii*, as illustrated by E. v. Mojsisovics in fig. 1 of the supplement to the first volume of the Hallstatt Cephalopoda.

Dimensions.

Diameter of the shell		cca. 350 mm.
,, ,, ,, umbilicus		30 ,,
Height of the last volution	above the umbilical suture	194 ,,
	,, ,, preceding whorl	108 ,,
Thickness of the last volution		44 ,,

The specimen being entirely chambered, the diameter of the individual, including the body-chamber, cannot have been less than 500 mm.

Sutures.—The complicated sutural line agrees far better with that of *Pinacoceras Metternichii* than with that of *P. parma.* The chief difference between the sutures of these two closely-allied species is the character of the fifth adventitious saddle. This saddle is dimeroid in *P. parma,* like the preceding adventitious saddle

In *P. Metternichii* it resembles the main saddles, the inner of the two culminating branches being much more strongly developed and higher than the outer one and being shifted towards the centre of the apex of the saddle. In this character my specimen agrees perfectly with *P. Metternichii*, not with *P. parma.* The general shape of the saddles, their very rich ramification and the symmetrical arrangement of their lateral branches are also in accordance with the type of sutures in *P. Metternichii.*

There are five adventitious saddles, three main saddles and ten auxiliary saddles outside the umbilical suture.

From the famous and often reproduced illustration of F. v. Hauer's type-specimen the sutures of this example deviate in two details.

The first point of difference is the steeper slope of the adventitious elements from the periphery of the shell to the first main saddle. This difference is of no specific importance. The slope of the adventitious elements in *Pinacoceras* is subject to considerable variation in the same individual according to the stage of its development. Together with the increasing height of the volution the slope of the adventitious elements becomes gradually less steep. Had the sutural line in my specimen been taken for illustration in the vicinity of the aperture, the arrangement of the adventitious saddles would agree much more closely with that in F. v. Hauer's type-specimen. It only needs a glance at the two figures 2 and 3 on Pl. XXVI of E. v. Mojsisovics' above-quoted monograph, both of them representing sutures of *Pinacoceras parma*, to see that the difference in the slope of their adventitious elements is even greater than between my Indian specimen and F. v. Hauer's Alpine type of *P. Metternichii.* This character can therefore not be considered as a feature of specific value.

The second and, perhaps, in the eyes of some palæontologists, more important difference is the development of a small secondary saddle at the base of the first adventitious saddle. This character recalls the variety *sub-parma* of *Pinacoceras-parma* v. Mojsisovics.

I am quoting E. v. Mojsisovics (Palæont. Indica, ser. XV, Himál. Foss., Vol. III, Pt. 1, p. 105), who can certainly not be regarded as an advocate of too wide a circumscription of species in ammonites :—

"The differences between *Pinacoceras parma* and *P. sub-parma* are so slight that it seems to me more advisable for the present to regard *P. sub-parma* as only a variety of *P. parma. P. sub-parma*, that is to say, is only distinguished by the small accessory saddle, occurring in the first (external) adventitious lobe. This saddle, as a comparison with *P. parma* shows, can only be regarded as the freed large outer accessory branch of the first adventitious saddle. A further difference between the two forms mentioned consists in the more slender shape of the principal saddles in *P. parma.*"

To a feature, which in *P. parma* can only claim a varietal rank, no specific value can be attributed in the very nearly allied *Pinacoceras Metternichii.* I am, consequently, following the view of E. v. Mojsisovics in considering the development of a secondary saddle in the first adventitious lobe as a character of only varietal importance, taking into consideration the extreme variability in the details of sutures in ammonites with an equally complicated sutural line.

3. PINACOCERAS BEECHERI nov. sp. Pl. XIII, fig. 2.

A large specimen of *Pinacoceras* from the Tropites-limestone of Tera Gádh (coll. Smith) may be considered as the prototype of a new species. It is nearly allied to *P. parma* v. Mojsisovics, from which it differs by its larger umbilicus and by the presence of a smaller number of adventitious elements in the sutural line.

The slowly increasing whorls overlap one another to the extent of only five-sixths of their height. Thus a comparatively wide umbilicus is formed, which is nearly twice as large as in specimens of *Pinacoceras parma* of equal size. The umbilicus is surrounded by a perpendicular wall. The external part is sharpened into a knife-like edge.

Dimensions.

Diameter of the shell	cca. 270 mm.
„ „ „ umbilicus	34 „
Height } of the last volution . . . . {	160 „
Thickness }	85 „

The specimen being entirely chambered, the dimensions of the complete individual, body-chamber included, were probably but slightly inferior to those of the specimen of *P. Metternichii* previously described.

Sutures.—In general shape and arrangement very similar to those of *Pinacoceras parma*, but with only four adventitious saddles. The fourth saddle is distinctly dimeroid, in remarkable contrast to the pyramidal first main saddle. Ten auxiliary saddles stand outside the umbilical suture. The three main lobes are less deep and less sharply pointed than in *P. Metternichii.*

B. Group of *Pinacoceras Imperator.*

4. PINACOCERAS cf. REX Mojsisovics. Pl. XIV, fig. 4.

1878. *Pinacoceras rex* E. v. Mojsisovics, Die Cephalopoden der Hallstatter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 65, Taf. XXIII, figs. 8, 9 ; XXIV, fig 8.
1902. *P. rex* E. v Mojsisovics, *ibid.* Supplementbd., p. 296.

The small, figured cast from the Tropites-limestone of Tera Gádh (coll. Krafft) is provisionally and with some reserve referred to this Alpine species, on account of its striking similarity to young individuals of *Pinacoceras rex.*

An equal-sized specimen of *P. rex* from the Subbullatus-beds of the Salzkammergut (Pl. XXIII, fig. 8) shows exactly the same shape and character of involution The first whorl is distinctly evolute. The following volutions embrace one another only very slightly. It is only the sixth whorl which overlaps the fifth in a normal manner.

By carefully breaking my specimen and studying its transverse section, I have been able to make out these characters, which, according to E. v. Mojsisovics are only met with in species of the group of *Pinacoceras imperator, viz., P. rex* and *P. Hutteri* Mojsisovics (l. c. Supplement bd. p. 296, Taf. XIX, fig. 3). From *P. Hutteri* our specimen differs by being absolutely smooth and devoid of any trace of ornamentation. There is, probably, a great chance of its being identical with *P. rex* from the carnic (julic and tuvalic) stage of the Hallstatt-limestone.

Dimensions.

Diameter of the shell		24 mm.
" " " umbilicus		3 "
Height of the last volution	above the umbilical suture	14 "
	" " preceding whorl	10·5 "
Thickness of the last volution		3 "

es.—Not known.

Sub-genus : *PLACITES* Mojsisovics.

The forms, which are described in the following pages under this sub-generic designation proposed by E. v. Mojsisovics in 1896, surpass, in number of individuals, all the other members of the Cephalopoda contained in the Himálayan collections from the Tropites-limestone of Byans.

All those examples with the exception of a single specimen, which was found to be provided with three adventitious lobes and two adventitious saddles, are linked together most intimately by similarity of shape and sutures. They belong to the group of *Placites platyphyllus* Mojsisovics. A closer examination most conclusively shows that, notwithstanding a slight variability in subordinate details, no distinction can be based on their rather indifferent characters and that they all must be united in one single species, which is identical with *Placites Oldhami*, Mojs. from the Daonella-beds of Lauka (Kumaon).

1. PLACITES POLYDACTYLUS VAR. OLDHAMI Mojs. Pl. XIV, figs. 7, 8, 9.

1896. *Placites Oldhami* E. v. Mojsisovics, Beiträge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wiss. Wien, Math. nat., Cl. Bd. LXIII, p. 664, Taf. XIX, fig. 2.

1899. *Placites Oldhami* E v. Mojsisovics, Upper triassic Cephalopodafauna of the Himálayas, Palæont. Indica ser XV, Himál. Foss. Vol. III, Pt. 1, p 111, Pl. XIX, fig. 2.

The typical form of this species, which I consider to be E. v. Mojsisovics' type-specimen and all the examples illustrated in the present memoir, does not differ remarkably from other species of the group of *Placites platyphyllus* in its general proportions, in its involution and in the shape of its transverse section. A closer examination is needed to discover subordinate differences, which may serve as distinctive features. The Alpine species, with which it agrees most closely in all its essential features, is *Pl. polydactylus* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 52, Taf. XXI, figs. 3—6). The more slender transverse section, the more highly rounded siphonal part and the presence of a very small but open umbilicous, which in the majority of my specimens is not closed, are the only characters on which a specific distinction from *Pl. polydactylus* might be based.

The only specimen known to E. v. Mojsisovics was of moderate size. But among my materials large examples have been met with, scarcely inferior in their dimensions to the type-specimen of *P. polydactylus* illustrated by E. von Mojsisovics (l. c. fig. 7).

The measurements of a fairly complete, medium-sized specimen are (fig. 8) as follows:—

Diameter of the shell	47	mm.
,, ,, ,, umbilicous	2	,,
Height of the last volution. above the umbilical suture	26	,,
,, ,, preceding whorl	16·5	,,
Thickness of the last volution	9·5	,,

Sutures.—The sutural line is absolutely identical with that of the specimen from Lauka, figured by E. v. Mojsisovics, but is also identical with that of the Alpine *Placites polydactylus* from the lower noric stage of the Hallstatt-limestone.

E. v. Mojsisovics, it is true, lays some stress on the fact that the outer lateral branch of the adventitious saddle is proportionately weakly developed in the Himálayan form and does not attain the dimensions which are reached by the Mediterranean species of the same group. I am, however, at a loss to verify this statement. The illustration on fig. 4 in the above-quoted memoir of E. v. Mojsisovics shows an exactly identical development in the outer branch of the adventitious saddle of *Pl. polydactylus* and of my type-specimens. My personal examination of the specimens from the Hallstatt-limestone has led me to the same conclusion. I am, therefore, bound to say, that I cannot separate the two species on account of supposed differences in their sutural lines.

The perfect identity of their sutures having been established, the question arises, whether their very slight external differences do really require a separation of the Indian form from the Alpine types. I myself do not consider a differentiation of the two species justified, but this is, as in so many other cases, a matter of individual conception or of personal judgment only. In order to acknowledge the presence of a few subordinate characters of distinction, the varietal name of *var. Oldhami* has been added to the Indian form of *Placites polydactylus* in the present description.

Placites polydactylus is a common species in the red marble of Goisern of lower noric age. The *var. Oldhami* has been collected by myself in the Daonella-beds of Lauka (Kumaon) and by Smith and A. v. Krafft in the Tropites-limestone of Tera Gádh, Kalapani, Nihal, Kuti and Lilinthi.

2. Placites sp. ind. ex aff. peraucti Mojsisovics. Pl. XXV, fig. 6.

1896. *Placites sp. ind. ex. aff. peraucti* v. Mojsisovics, Beitræge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wiss, LXIII, p. 664, Taf. XVIII, fig. 9.

1899. *Placites sp. ind. ex. aff. peraucti* E. v. Mojsisovics, Upper triassic cephalopodafaunae of the Himálayas, Palaent. Indica, ser. XV, Himálayan Fossils, vol. III, Pt. 1, p. III, Pl. XVIII, fig. 9.

The chambered fragment from the Tropites-limestone of Lilinthi (coll. Smith) belongs to a species of *Placites*, which is probably identical with a species from the upper Daonella-beds of the Bambanag section, collected by myself in 1892 and described and figured by E. v. Mojsisovics. It must, however, be borne in mind that the fragmentary character of the two specimens does not permit a direct identification.

The agreement of the sutural lines in the two examples is very remarkable, especially the absolute identity of the development of three adventitious lobes. The auxiliary series is not accessible to observation.

Genus: Bambanagites v. Mojsisovics.

Bambanagites Kraffti nov. sp. Pl. XIV, fig. 2.

Representatives of this remarkable genus of *Pinacoceratidæ* have so far been known from the Halorites-limestone of the Bambanag range only by E. v. Mojsisovics (Palæont. Ind. ser. XV, Himál. Foss. vol. III, Pt. 1, p. 106). Two species have been described by this author, both of them being distinguished from all European *Pinacoceratidæ* by the simple and primitive structure of their sutures.

In A. v. Krafft's collections from the Tropites-limestone of Lilinthi the genus *Bambanagites* is represented by a single specimen, which exhibits the peculiar characters of the genus most distinctly, but differs from the two species described by E. v. Mojsisovics in some subordinate features. It must consequently be kept separate from them and receive a new denomination, for which I propose the name of its discoverer, the late A. v. Krafft.

My specimen, consisting of air-chambers only, shows closely embracing and strongly compressed whorls with a very small umbilicus. The lateral parts are almost flat and converging gradually towards the siphonal part. The greatest transverse diameter of the shell is situated in the vicinity of the umbilical region. There is no umbilical edge present, but the flanks pass into the steep umbilical wall in a strongly bent curve.

On the siphonal side the two flanks meet in a sharp, knife-like edge. This character alone is sufficient to distinguish our species at the first glance from *Bambanagites Schlagintweiti* Mojs. and *B. Dieneri* Mojs.

The sculpture is restricted to the inner volutions and to the beginning of the last whorl. It closely resembles the sculpture of *Pinacoceras Layeri* v. Hauer, which has been lately elevated to the rank of a proper sub-genus *Pompeckjites* by E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, l. c. VI-1, Supplement-bd.,

p. 298). This sculpture consists of short and broad transverse folds which are separated by narrow intercostal furrows. No tubercles are developed along the top of the folds. The folds of the two flanks do not correspond, but each fold of one lateral part unites with a furrow on the opposite flank. Thus the profile of the siphonal edge assumes a wave-like appearance. In the anterior portion of the last volution no trace of sculpture is noticed.

Sutures.—In its general arrangement the sutural line agrees with the sutures of *Bambanagites Schlagintweiti* and *B. Dieneri*. It consists of three adventitious, two principal and a large number of auxiliary lobes. The adventitious and main saddles are slender, elongated and serrated, with rounded tops. The auxiliary saddles are broad and partly bipartite.

The external adventitious lobe, which takes the place of the siphonal lobe in ammonites with the normal number of lobes, is divided by a broad median prominence with deeply incised borders. The lobe itself, bordering the first adventitious saddle, is divided at its base into two digitations of unequal length. The two following adventitious lobes end in a single terminal digitation. The third or inner lobe stands as deep as the external lobe, whereas the central adventitious lobe is considerably shorter.

The principal lateral lobe, which exceeds all the other lobes in depth, ends in a single digitation, provided with two short terminal points, but is bordered by comparatively deep lateral branches on either side, imparting to this lobe a tendency to a phylloid structure. The second lateral lobe is nearly as broad as the principal and terminates in two sharp points.

The principal and adventitious saddles are all elongated. A strong serration affects their walls, leaving only the uppermost, leaf-shaped extremities entire. The third adventitious and the principal lateral saddles are even provided with little lateral branches.

There is a great contrast in the development of the main saddles and of the auxiliary series.

The second lateral saddle is bordered by walls of very unequal height. Its umbilical wall is very low and followed by a small lobe, which opens the auxiliary series. Each of the auxiliary saddles is dimeroid, but the depth of the true auxiliary lobes is but slightly larger than that of the indentations between the two tops of a bipartite saddle. It seems as if by fusion of every two neighbouring simple saddles the dimeroid auxiliary saddles were developed in the same manner as described in the case of *Bambanagites Dieneri* by E. v. Mojsisovics.

There are five low auxiliary saddles between the first auxiliary saddle and the umbilical suture.

Dimensions.

Diameter of the shell		cca. 78 mm.
„ „ umbilicus		„ 2·5 „
Height of the last volution	above the umbilical suture	„ 51 „
	„ „ preceding whorl	„ 30 „
Thickness of the last volution		„ 14·5 „

The present species is a typical representative of the genus *Bambanagites*, closely agreeing with *B. Dieneri* in the arrangement of its sutural line.

It is only distinguished from the species hitherto described by the development of an acute siphonal edge.

Family: *NORITIDÆ* Mojs.

Genus: CARNITES Mojsisovics.

CARNITES cf. FLORIDUS Wulfen. Pl. XIV, fig. 1.

1793. *Nautilus floridus* Wulfen, über den Karnthnerischen, pfauenschweifigen Helmintholit, p. 113, Taf. XVIII, fig. 16, XXII, figs. 15, 16, XXIII, fig. 16.

1846. *Ammonites floridus* v. Hauer, Über die Cephalopoden des Muschelmarmors von Bleibrg Haidinger's Naturwissensch. Abhandl. I. Bd. p. 22, Taf. I, figs. 5-14.

1873. *Pinacoceras floridum*, v. Mojsisovics, Die Cephalopoden der Halstatter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 58, Taf. XXII, figs. 15, 16; XXV, figs 1-6.

1882. *Carnites floridus* v. Mojsisovics, Die Cephalopoden der Mediterranen Triasprovinz, Abhandl. K. K. Geol. Reichsanst. Bd. X, p. 228, Taf. L, figs. 5-8; LI, figs. 1-8.

1890. *Carnites floridus* Diener, Mitheilungen über einige Cephalodensuiten aus der Trias des suedlichen Bakony. Aus dem palæontologischen Anhang zu "Resultate der wissenschaftlichen Erforschung des Balatonsees," Bd. I, 1. Theil. p. 17.

1902. *Carnites floridus* v. Mojsisovics. Die Cephalopoden der Hallstatter Kalke l. c., VI-1, Supplementbd., p. 312.

Ammonites floridus has often been quoted from the Triassic strata of the Himálayas. *Buddhaites Rama* Dien. and *Hungarites (Rimkinites) nitiensis* Mojs. have both been mistaken for the Alpine species by Suess Salter, Stoliczka, Griesbach and by the authors of the first edition of the "Manual of the Geology of India."

Among the ammonites collected in the Tropites-limestone of Lilinthi by the late Dr. A. v. Krafft, there is an incomplete but well-preserved specimen which seems to be very closely allied to *Carnites floridus*. In this Alpine species the range of circumscription is wider than is unusually the case in species of Cephalopoda described by E. v. Mojsisovics. But the differences between forms which have hitherto been attributed to *Carnites floridus* are not less important than such as may be detected between them and my Himálayan specimen.

In its external characters the present specimen agrees almost perfectly with the example illustrated by E. v. Mojsisovics in his "Cephalopoden der Mediterranen Triasprovinz" Pl. LI, fig. 6. It is a cast comprising one entire volution, but with its anterior portion partly broken off. Its most remarkable feature is the acute siphonal edge. This feature is likewise exhibited in the above quoted Alpine type from Deutsch-Bleiberg, whereas in the majority of examples of *Carnites floridus* the siphonal part is provided with two keels running parallel and standing very close to each other. Fig. 8 in the above quoted memoir of E. v. Mojsisovics clearly proves that the difference in this feature is not due to a difference in the shape of casts and of specimens provided with their shell. The sharpening of the siphonal part to a knife-like edge is already exhibited at the beginning of the last volution. My specimen being the only representative of the species, I have not attempted to develop its inner whorls. Thus its earlier stages of growth are not known to me.

The volutions overlap one another so completely that only a very narrow umbilicus is left open. The greatest transverse diameter of the shell corresponds to the umbilical region. From this region the lateral parts converge gradually towards the siphonal edge, imparting to the section of the whorls the shape of an arrow-head.

Dimensions.

Diameter of the shell		cca. 72 mm.
" " " umbilicus		2 "
Height of the last volution	above the umbilical suture	39 "
	" " preceding whorl	24 "
Thickness of the last volution		15 "

Sutures.—In its general outlines the sutural line of the Himálayan specimen strongly resembles that of *Carnites floridus.* There are, however, three adventitious elements clearly marked. The siphonal lobe is divided into two separate elements by a remarkable prominence, which assumes the character of a proper adventitious saddle. Thus in our specimen the second adventitious saddle corresponds to the external adventitious saddle in the majority of Alpine representatives of this species. The following adventitious element is the largest and is but slightly surpassed in size by the principal lateral lobe and saddle.

The second lateral lobe is broad and low, standing on an equal level with the auxiliary series.

The similarity of the sutural line of this specimen with the sutural lines figured by E. v. Mojsisovics in his monograph of the Hallstatt Cephalopoda is far greater than with those illustrated by that author in his "Cephalopoden der Mediterranen Triasprovinz." Notwithstanding this obvious similarity there remains the remarkable difference that in the Alpine *Carnites floridus* only two adventitious elements are present, the prominences, which are developed in the siphonal lobe in later stages of growth, never assuming the character of proper saddles. This is, at least, the opinion expressed by E. v. Mojsisovics.

There seem, however, to be exceptions to this rule. The specimen illustrated by E. v. Mojsisovics in his "Cephalopoden der Hallstätter Kalke," l. c., VI Pl. XXV, fig. 4, exhibits a sutural line, the arrangement of which agrees almost perfectly with that of the sutures of my Himálayan form. One of the prominences of the siphonal lobe has been developed into a proper saddle. Thus three, instead of two, adventitious elements are exposed in the example from Deutsch-Bleiberg in Carinthia.

It might, of course, be a matter of discussion whether this Alpine type, with three adventitious elements, should or should not be considered identical with *Carnites floridus.* But this is a question of minor importance. What I wish to prove is the fact, that types closely agreeing with my Himálayan specimen are represented among the group of European forms, to which the denomination of *Carnites floridus* has hitherto been assigned.

If any palæontologist should wish to spilt up the species of *Carnites floridus* into a number of separate species, I have no objection to offer. Indeed I consider that the two varieties from Deutsch-Bleiberg and from the Salzkammergut differ to such an extent in the shape of their transverse section and of the siphonal part, that they should not be united under the same specific name. But in any case the Himálayan specimen here described, will have to remain within the group of Alpine *Carnites*, of which it is the first true representative hitherto discovered in India.

There are representatives of two more genera of Triassic ammonites to which the present specimen from Lilinthi might be compared, *viz.*, *Paratibetites* and *Hauerites*. Both of these are distinguished by the presence of two marginal keels, although in *Paratibetites Tornquisti* those two keels are replaced by a blunt blade, thus resembling the external shape of our *Carnites*. The arrangement of the sutural line exhibits, however, but little affinity. The adventitious elements are packed much more closely to each other and their characters as proper adventitious saddles are yet so indistinctly marked, that they may with equal reason be considered as the two unequal halves of one single bipartite saddle only. Far more remarkable is the affinity to the sutural line of *Hauerites*.

From the group of beds No. 6 of the Bambanag section a fragment has been described by E. v. Mojsisovics as *Hauerites sp. ind.* (Palæont. Indica ser. XV. Himál. Foss. Vol. III, Pt. I, p. 88, Pl. XVI, fig. 6). Its sutures closely agree with those of my specimen in their general arrangement, being, however, more strongly serrated and showing a distinct tendency to a phylloid structure by the development of little lateral branches of the larger saddles instead of the simple denticulations of *Carnites*. But otherwise its affinity is striking. The external lappet of the median prominence is developed into a proper adventitious saddle. The following lobe corresponds to the siphonal lobe in *Carnites*. Of the two adjoining saddles the second is the larger and is pyramidal, exactly as in my specimen from the Tropites limestone of Lilinthi. I have, indeed, strong objections to raise against the correctness of assigning the fragment from the Bambanag range to the genus *Hauerites*.

E. v. Mojsisovics describes this fragment as being provided with a bluntly pointed external part, and justly remarks, that the tapering of the siphonal part to a blunt blade without a furrow has never been observed in *Hauerites*. I believe that the fragment, collected by myself in the Bambanag section, ought to be classed among the nearest allies of *Carnites* and may, perhaps, be a descendant of the species here described.

If a special subgeneric denomination should be considered desirable for its distinction, the species identified with *Hauerites* by E. v. Mojsisovics might advantageously take the name of ***Metacarnites***.

Family: *MEGAPHYLLITIDÆ* Mojs.

Genus: MEGAPHYLLITES Mojsisovics.

MEGAPHYLLITES JARBAS Münster. Pl. III, fig. 11.

1841. *Ceratites Jarbas* Graf zu Münster, Beiträge zur Geog. und Petrefactenkunde des südoestlichen Tirol, p. 135, Taf. XV, fig. 25.
1845. *Ammonites umbilicatus* A. v. Klipstein, Beiträge zur Geol. Kenntniss der östlichen Alpen, p. 117, Taf. VI, fig. 5.
1846. *Ammonites Jarbas* F. v. Hauer, Cephalopoden des Muschelmarmors zu Bleiberg, Haidinger's Naturwiss. Abhandl. I, Bd. p. 26, Taf. 1, fig. 15.
1847. *Ammonites Jarbas* F. v. Hauer, Neue Cephalopoden von Aussee, ibid. Bd. I., p. 271.
1849. *Ammonites Jarbas* Quenstedt, Cephalopoden, p. 240, Taf. XVIII, fig. 12.
1869. *Ammonites* (*Phylloceras*) *Jarbas* Laube, Fauna der Schichten von St. Cassian, Denkschr. Kais. Akad. d. Wissensch. Wien. XXX, p. 85, Taf. XLI, fig. 12.
1873. *Pinacoceras cf. Jarbas* E. v. Mojsisovics, Das Gebirge um Hallstatt. Abhandl. K. K. Geol. Reichsanst. VI-1, p. 47, Taf. XIX. figs. 9, 10, 16.
1882. *Megaphyllites Jarbas* E. v. Mojsisovics, Die Cephalopoden der Mediterranen Triasprovinz, Abhandl. K. K. Geol. Reichsanst. X, p. 193, Taf. LII, figs. 7. 8.
1902. *Megaphyllites Jarbas* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, ibid. VI—1, Supplementband, p. 314.

This is one of the commonest species of the *Ammonea leiostraca* in the zones of *Trachyceras Aon* and *Tr. Aonoides* in the Trias of the Eastern Alps. It is represented in A. v. Krafft's collection from Tera Gádh by three specimens, one of them provided with its body-chamber, reaching a diameter of 30 mm.

My Himálayan examples are absolutely identical with the type-specimens from the carnic Hallstatt limestones of Aussee, illustrated by E. v. Mojsisovics. The flattening of the lateral parts, characteristic of this species, is already exhibited in the small specimen illustrated, which consists of air-chambers only. It is still more conspicuous in the body-chamber specimen, which agrees most closely with the large example, illustrated on Pl. XIX, fig. 10, of the Hallstatt monograph. The umbilicus is entirely closed.

Dimensions.

	Chambered specimen (fig. 11).	Body-chamber specimen.
Diameter of the shell	19 mm.	30 mm.
„ „ „ umbilicus	0 „	0 „
Height of the last volution above the umbilical suture	10·5 „	18 „
„ „ preceding whorl	6 „	11 „
Thickness of the last volution	8 „	12 „

Sutures.—Agreeing almost entirely with those of the Alpine specimen from Stuores near St. Cassian, illustrated in Cephalopoden der Mediterranen Triasprovinz, Taf. LII, fig. 8. Insignificant differences are noticed in the relative height of the siphonal saddle and second lateral lobe.

Family: *LYTOCERATIDÆ* Neumayr.

Subgenus: *DISCOPHYLLITES* Hyatt.

DISCOPHYLLITES EBNERI v. Mojsisovics. Pl. V, fig. 5.

1896. ***Phylloceras Ebneri*** E. v. Mojsisovics, Beiträge zur Kenntniss der obertriadischen Cephalopodenfaunen des Himálaya, Denkschr. kais. Akad. d. Wiss. Wien. LXIII, p. 668, Taf. XIX, fig. 6.

1899. ***Phylloceras Ebneri*** E. v. Mojsisovics, upper Triassic Cephalopodafaunæ of the Himálayas, Palæont Indica, ser. XV, Himál. Foss. Vol. III, Pt. 1, p. 116, Pl. XIX, fig. 6.

The two genera ***Monophyllites*** Mojs. and ***Rhacophyllites*** Zittel are connected by a very interesting group of transitional types, for which a new subgenus, ***Discophyllites***, has been proposed by A. Hyatt (in Zittel's Text-book of Palæontology, London, 1900, Vol. I, p. 566). It is represented by two very nearly allied species, ***Discophyllites patens*** Mojs. in the European, and ***D. Ebneri*** in the Indian Trias.

The collections from the Tropites-limestone of Lilinthi (A. v. Krafft) and of Kalapani (Smith) contain a rich material of ***Discophyllites Ebneri***. Of this species only a single incomplete specimen from the Daonella-beds of Lauka in Kumaon was known to E. v. Mojsisovics.

The examination of my materials proves that the typical form is subject to slight variations in the width of the umbilicus and in the rate of involution. Whereas the majority of specimens in this respect almost perfectly agree with ***D. patens*** Mojs. from the noric Hallstatt-limestone, there are a few examples, in which the volutions increase more rapidly and the umbilicus is, consequently, less widely opened. It is, however, only right to add that the different varieties are connected by intermediate gradations and that the variations themselves are of such small importance that there is no reason to separate those varieties into several specific forms.

The figured specimen is a good example of the second variety, distinguished by less slowly increasing whorls and by its smaller umbilicus.

This specimen is the only one among my materials which is provided with a part of its body-chamber, which forms one-third of the last volution.

Its measurements are as follows:—

Diameter of the shell	60 mm.
" " " umbilicus	26 "
Height of the last volution { above the umbilical suture	23·5 "
" " preceding whorl	18·5 "
Thickness of the last volution	18 "

In its transverse section the specimen agrees entirely with ***D. patens***. Fragments of the shell, which have been partly preserved, are nearly smooth, with only delicate striæ of growth.

Sutures.—The only important feature of distinction between *Discophyllites patens* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 84, Taf. XVI, fig. 13; XIX, fig. 17) and *D. Ebneri* is the sutural line.

As the poor state of preservation of the type specimen from Lauka prevented the full exposure of its sutures, I am able to complete their somewhat fragmentary description given by E. v. Mojsisovics.

The siphonal lobe is deeper and narrower than in *D. patens* and divided by a high median prominence. The siphonal saddle is not monophyllic, as had been supposed by E. v. Mojsisovics, but distinctly diphyllic. But in contrast to the following saddles, the inner, not the outer, terminal leaf is more strongly developed. In the second lateral saddle the monophyllic plan is much more distinctly marked than in *D. patens*, the large terminal leaf being followed on either side by a smaller one, both standing on an equal level. The inner secondary leaf marks the beginning of several similar club-shaped phylla, which together form a sort of suspensive lobe and correspond to a rudimentary auxiliary series.

Remarks.—There exists also a very close affinity between this species and *Discophyllites insignis* Gemmellaro (I cefalopodi del Trias superiore della parte occidentall della Sicilia, p. 298, Taf. I, figs. 21, 22; Taf. IX, figs. 13-16), from the Triassic limestone of Castronuovo in Sicily. But I think that Gemmellaro has been perfectly right in separating them, although none of the characters of distinction enumerated by him can be really considered to be of specific value. As such characters the following may be noticed.

The cordiform transverse section of *Discophyllites insignis* differs by more strongly converging lateral parts. In the sutural line differences are also noticed. The siphonal lobe of *D. insignis* is considerably shorter; the external margin of the siphonal saddle has no secondary leaf underneath the upper main phyllum, the principal lateral saddle does not show a distinct triphyllic arrangement of its terminal leaves as in *D. Ebneri*. In all saddles the external leaves stand on a lower level, in proportion to the inner ones, than in *Discophyllites Ebneri*.

The three hitherto described species of the genus *Discophyllites* form a well-defined group of very closely allied forms, ranging from middle carnic into lower noric strata.

B. ARCESTOIDEA (LEIOSTRACA MACRODOMA).

Family: *ARCESTIDÆ.*

Genus: ARCESTES Suess.

Arcestidæ, as is well known, play a very important part in limestone deposits of the Alpine Trias. In the Indian Triassic province only very few species have hitherto been found. E. v. Mojsisovics, indeed, states the preponderance of

Ammonea Trachyostraca and the remarkable rarity of *Arcestidæ* in the rich upper Triassic faunæ of the Himálayas to be one of their most striking peculiarities. Regarding the distribution of *Arcestidæ* and *Trachyostraca* in the Tropites limestone of Byans their proportion more nearly approaches that which we are wont to find in the Hallstatt limestone of Europe than in deposits of the Indian Triassic province. In the Tropites limestone of Tera Gádh, Kalapani, Kuti and Lilinthi, *Arcestidæ* occur in very large numbers, but the important part which they play in this fauna does not find an adequate expression in the description of the few species given in this memoir.

The overwhelming majority of more than one hundred examples of *Arcestidæ* are inner nuclei and consequently unfit for specific determination. Every palæontologist, who has had to deal with representatives of this family, knows the difficulty of exact determinations, if both full-grown individuals and inner nuclei of the same species are not available for examination. I have, consequently, been obliged to leave many examples undetermined and I have preferred to describe only such specimens as are fit for a diagnosis of the species. But the number of species of *Arcestidæ* represented in the fauna of the Tropites-limestone is certainly larger, especially among the group of *Arcestes intuslabiati*.

1. ARCESTES DICERUS v. Mojsisovics. Pl. XII, fig. 14.

1873. *Arcestes dicerus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 122, Taf. XLVII, fig. 1, LIII, fig. 20.

The figured specimen from the Tropites-limestone of Kalapani (coll. Krafft), consisting of a chambered nucleus and body-chamber with its peristome, is most probably identical with *Arcestes dicerus* Mojs. from the noric stage of the Hallstatt limestone. Its shape, involution and size agree exactly with that of the shell in the European examples of *Arcestes dicerus*.

The volutions are higher than thick. The umbilicus is open, not closed by a callosity. The inner nucleus, part of which has been laid bare by splitting off the body-chamber volution, agrees with inner nuclei of *A. intuslabiatus* in the presence of labiæ, which are slightly curved forward in the external region. The peristome shows two strong, horn-like projections, which laterally border a deep sinus on the siphonal part, whose convexity is turned backwards. From the umbilicus the apertural margin runs in a straight line to the anterior extremity of the horn-like projections. The lateral contraction of the peristome is not considerable, as is shown in an illustration of the front view of my specimen (fig. 14B).

Dimensions.

Diameter of the shell		47 mm.
" " " umbilicus		cca. 3 "
Height of the last volution	above the umbilical suture	26·5 "
	" " preceding whorl	11 "
Thickness of the last volution		22 "

Sutures.—Not known in detail.

2. ARCESTES BICORNIS v. Hauer. Pl. XII, fig. 16.

1860. *Arcestes bicornis* E. v. Hauer, Nachtræge zur Kenntniss der Cephalopodenfauna der Hallstätter Schichten, Sitzgsber. Kais. Akad. d. Wissensch. 41, Bd. p. 143, Taf. IV, figs. 4-7.
1873. *Arcestes bicornis* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst. VI-1, p. 127, Taf. XLVII, figs. 4-6 ; LIII, fig. 25.

The differences between *Arcestes bicornis* and *A. subbicornis* Mojsisovics (Palæont. Indica, ser. XV, Himál. Foss. Vol. III, Pt. 1, p. 99, Pl. XX, fig. 5) are very slight. *A. subbicornis*, according to the diagnosis given by E. v. Mojsisovics, is only distinguished by the presence of an apertural sinus with its concavity directed forward, between the two horn-like projections of the peristome. Most of my specimens from the Tropites limestone of Kalapani and Tera Gádh have the apertural margin cut off between the two horns of the peristome in a straight line, exactly as in the typical *A. bicornis* from the Subbullatus-beds of the Hallstatt-limestone.

In a minority of examples a small sinus is developed, but is inferior in size to that of the peristome in *Arcestes decipiens* v. Mojsisovics (Cephalopoden der Hallstätter Kalke, l. c., p. 133, Taf. LIV, figs. 2, 3), which has been compared to *A. subbicornis* by E. v. Mojsisovics. As this character is so poorly developed in some of my Himálayan specimens, which otherwise closely agree with F. v. Hauer's type, especially in the geniculation of the shell, I have united them with *A. bicornis*.

The two figured specimens are typical examples of *Arcestes bicornis*, agreeing with this Alpine species in their dimensions, in the oviform outline, the closed umbilicus and the shape of the peristome. The knee-shaped bend at the beginning of the last volution has been noticed in one of my specimens after the removal of the body-chamber.

Dimensions.

Diameter of the shell		24 mm
„ „ „ umbilicus		0 „
Height of the last volution	above the umbilical suture	14 „
	„ „ preceding whorl	6 „
Thickness of the last volution		11 „

Sutures.—Not known.

3. ARCESTES SUBBICORNIS v. Mojsisovics.

1896. *Arcestes subbicornis* E. v. Mojsisovics, Beiträge zur Kenntniss der obstriadischen Cephalopodenfaunen des Himálaya, Denkschr. Kais. Akad. d. Wiss. LXIII, p. 654, Taf. XX, fig. 10.
1899. *Arcestes subbicornis* E. v. Mojsisovics, upper Triassic Cephalopodafaunæ of the Himálayas, Palæontologia Indica, ser. XV. Himál. Foss. Vol. III, Pt. 1, p. 99, Pl, XX, fig. 10.

Among the materials from Tera Gádh collected by Smith, there is a single fragment of the anterior portion of a body-chamber, which shows the two horn-like projections of the peristome laterally bordered by a deep sinus, whose concavity is directed forward. It is the only specimen of *Arcestes* in the Himálayan collection in which this character has been distinctly noticed. I therefore do not hesitate to identify this fragment with *Arcestes subbicornis* v. Mojsisovics.

The complete specimen must have attained large dimensions, the transverse diameter of the peristome measuring 21 mm.

Subgenus: *Proarcestes* Mojsisovics.

1 (4). Proarcestes cf. Gaytani v. Klipstein. Pl. XII, figs. 10, 11.

1845. *Ammonites Gaytani* v. Klipstein, Beitræge zur Geologischen Kenntniss der oestlichen Alpen, p. 110, Taf. V, fig. 4.

1847. *Ammonites Gaytani* F. v. Hauer, Neue Cephalopoden von Aussee, Haidinger's Naturwissensch Abhandl. I, p. 267.

1849. *Ammonites Gaytani* F. v. Hauer, Neue Cephalopoden von Hallstatt und Aussee, *ibid.* III, p. 17, Taf. IV, figs. 13, 14.

1869. *Arcestes Gaytani* Laube, Fauna der Schichten von St. Cassian, Denkschr. Kais. Akad. d. Wissensch. math. nat., Cl. XXX, Bd., p. 89, Taf. XLIII, fig. 5.

1873. *Arcestes Gaytani* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 100, Taf. LVIII, figs. 1, 3.

1902. *Proarcestes Gaytani* E. v. Mojsisovics, *ibid.* Supplementbd., p. 259.

The few Indian specimens from the Tropites-limestone of Kalapani (coll. Smith) agree very closely with *Proarcestes Gaytani*, as is to be seen from the illustrations of a chambered internal cast and of a nearly complete example with its body-chamber. The latter is a medium-sized specimen, my largest individuals being only little inferior in size to the type-specimen from the Roethelstein illustrated by E. v. Mojsisovics.

Body-chamber volutions and inner nuclei do not differ in shape. In both of them the umbilicus is open. The lateral parts are not quite regularly rounded, but show, though only to a certain extent, the flattening characteristic of *Proarcestes Gaytani*. This feature is clearly marked only in full-grown individuals. The cross section is of nearly equal length and width.

In the last volution of the chambered cast (fig. 11) a faintly marked contraction is noticed. It occurs near the aperture of the volution. The line, which in the illustration might, perhaps, be mistaken for a second labia, is only an accidental fissure in the cast. The body-chamber volution does not show any trace of shell furrows or inner shelly ridges.

Dimensions.

Diameter of the shell	41	mm.
„ „ „ umbilicus	5	„
Height of the last volution above the umbilical suture	19	„
Height of the last volution „ „ preceding whorl	7·5	„
Thickness of the last volution	21	„

Sutures.—The differences in the details of the sutural line between the specimen figured and the European examples illustrated by E. v. Mojsisovics, are not sufficiently conspicuous to preclude their being attributed to individual variation. The saddles, it is true, are more slender and less richly leptophyllic, but in this respect similar variation is also seen in European specimens of *P. Gaytani*. There are even some individuals, in which the details of the sutures are different on both sides of the shell.

The type of sutures is that peculiar to the group of *Arcestes bicarinati* (*Proarcestes*). The two principal saddles are situated on the siphonal part. There are at least three auxiliary saddles outside the umbilical suture, but I have not succeeded in developing the auxiliary series in the umbilical region.

Remarks.—The only slight difference, which I have noticed between the Hallstatt type and my Indian specimens, is the somewhat less flattened character of the flanks in the latter. In this respect they recall, perhaps, the unnamed species from the Halorites-limestone of the Bambanag range, which has been described as *Proarcestes sp. ind* by E. v. Mojsisovics, but not illustrated in the Palæontologia Indica (ser. XV. Himálayan Foss. Vol. III, Pt. 1, p. 100).

Although I am inclined to consider my Himálayan specimens as identical with *Proarcestes Gaytani*, I have referred them to this European species only as *cf.*, on account of this slight difference in the shape of the cross-section.

Subgenus: *PARARCESTES* Mojsisovics.

1 (5). PARARCESTES nov. sp. ex aff. ZITTELI Mojs. Pl. XII, fig. 19.

The species, which is represented in the Himálayan collection by a single but perfectly preserved specimen with body-chamber and peristome, from Kalapani, shows in its external shape a great resemblance to *Pararcestes Zitteli* v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1 p. 95, Taf. LVI, figs. 1, 2), from the carnic stage of the Hallstatt-limestone.

It agrees with this species in its most remarkable feature, the strong inflation of the last volution in the vicinity of the peristome, which is connected with a flattening of the siphonal area. It is distinguished from *Pararcestes Zitteli* by the shape of the two broad and deep labiæ. In *P. Zitteli* the labiæ converge from either side towards the siphonal part, where they meet in a sharp angle. In the present species they cross the siphonal area in a very flat curve, with its convexity slightly turned forward, exactly as in *Pararcestes sublabiatus* Mojs.

Another feature of distinction consists in the knee-shaped bend of the body-chamber a quarter of one volution behind the peristome. In this character our species recalls *P. genuflexus* Mojsisovics (l. c., p. 97, Taf. L, fig. 8; LIII, fig. 29).

The cast is almost perfectly smooth. In the vicinity of the peristome there are very delicate falciform striæ. The apertural margin, which has been entirely preserved, follows exactly the direction of those falciform striæ, describing a very flat sinus on the external part.

Near the beginning of the last volution traces of the last air-chambers have been noticed. The body-chamber consequently does not attain the length of an entire volution. This fact has also been noticed in *Pararcestes genuflexus* Mojs. and in *P. oligosarcus* Mojs.

Dimensions.

Diameter of the shell	47	mm.
„ „ „ „ at the place of genuflexion	55	„
„ „ „ umbilicus	?	„
Height of the last volution above the umbilical suture	23·5	„
Height of the last volution „ „ preceding whorl	10	„
Height of the last volution at the place of genuflexion	27	„
Thickness of the last volution at the place of genuflexion	29	„
Thickness of the last volution	32	„

Sutures.—Not known in detail.

2 (6). PARARCESTES cf. STURI v. Mojsisovics. Pl. XII, fig. 18.

1873. *Arcestes Sturi* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 96, Taf. LVI, fig. 4.

The figured specimen from Kuti (coll. Krafft) consisting of a body-chamber without the peristome, belongs to a species of the group of *sublabiati* and appears from the shape of its cross-section to be most nearly allied to *Pararcestes Sturi* from the carnic stage of the Hallstatt-limestone. It has been provisionally referred to the species as *cf.*, but its identity is as yet uncertain.

At the beginning of the last volution the siphonal part is regularly rounded, but in later stages of growth it is sharpened into a bluntly rounded edge. Near the aperture an indistinct furrow is noticed on the cast.

The umbilicus was probably not closed though very narrow, but this cannot be ascertained, the umbilical region having been partly injured by weathering.

Dimensions.

Diameter of the shell	44	mm.
„ „ „ umbilicus	?	„
Height of the last volution above the umbilical suture	23	„
Height of the last volution „ „ preceding whorl	8·5	„
Thickness of the last volution	21	„

Sutures.—Not known.

3 (7). PARARCESTES sp. ind. ex aff. SUBLABIATO Mojs. Pl. XII, fig. 12.

The figured specimen from Lilinthi (coll. Krafft.) bears in its outward shape a strong resemblance to *Joannites*, but is provided with sutures characteristic of *Arcestes*. It may, in all probability, be assigned to a species of the group of *Pararcestes sublabiatus* E. v. Mojsisovics (Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 94, Taf. LV. fig. 12).

The last air-chamber is situated at the beginning of the last volution, which consequently belongs to the body-chamber. The peristome has not been preserved.

The whorls are high-mouthed, with flatly arched lateral parts and with a regularly rounded siphonal area, which becomes somewhat flattened in the vicinity of the aperture. In the penultimate whorl the umbilicus is narrow but open, whereas in the last volution it gradually tends to close, although not entirely.

Three furrows or labiæ are counted on the cast of the last volution. They are slightly falciform as in *Joannites Klipsteini* Mojsisovics (l. c., p. 84, Taf. LXI, figs. 2, 3), and not straight as in *Pararcestes sublabiatus.* They cross the siphonal part in a radial direction without turning forward anteriorly.

Shell covered with numerous delicate striæ of growth. Cast entirely smooth.

Dimensions.

Diameter of the shell	64 mm.
" " " umbilicus	1 "
Height of the last volution { above the umbilical suture	34 "
" " preceding whorl	14 "
Thickness of the last volution	23 "

Sutures.—Agreeing with those of *Pararcestes sublabiatus.* Four auxiliary saddles outside the umbilical suture. Only the siphonal saddle is situated on the external part.

Remarks.—In the Himálayan collection the group of *Arcestes sublabiati* (*Pararcestes*) is represented by a few more specimens, which are certainly not identical with the present one. Their specific determination is impossible on account of their defective state of preservation. It is nevertheless interesting to establish the fact that the subgenus *Pararcestes,* unknown hitherto in the Indian Trias, is rather richly represented in the fauna of the Tropites-limestone of Byans.

Subgenus: *STENARCESTES* v. Mojsisovics.

1 (8). STENARCESTES nov. sp. ind. ex aff. POLYSPHINCTO Mojs. Pl. XII, fig. 13.

Four specimens from the Tropites-limestone of Kalapani are casts of body-chamber volutions, with weathered fragments of the shell preserved. All of them are of small size, the largest example attaining a diameter of 35 mm.

In its general shape and involution this new species of the group of *Arcestes subumbilicati* (*Stenarcestes*) agrees with *St. polysphinctus* v. Mojsisovics (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 146, Taf. LXVIII, fig. 7) from the noric Hallstatt-limestone of the Sommeraukogel. It has compressed, high-mouthed whorls, with flattened lateral parts and a rounded siphonal area. The siphonal margin is more distinctly marked than in the European form. The umbilicus is open.

The species is easily distinguished from *Stenarcestes polysphinctus* by its smaller number of labiæ, of which only four are counted to one volution. In number of labiæ the present species agrees with *Stenarcestes planus* E. v. Mojsisovics (l. c., p. 146, Taf. LXVIII, figs. 5, 6), from which it differs by the shape of its siphonal part, which is narrow or even acute in *St. planus.*

Dimensions.

Diameter of the shell	26·5 mm.
„ „ „ umbilicus	2·5 „
Height of the last volution above the umbilical suture	13·5 „
Height of the last volution „ „ preceding whorl	7 „
Thickness of the last volution	10 „

Sutures.—Not known in detail.

2 (9). STENARCESTES sp. ind. aff. SUBUMBILICATO Bronn (?).

A specimen from Kalapani, with its body-chamber partly preserved and unfit for illustration, recalls the well-known *Stenarcestes subumbilicatus*, one of the leading types of the noric stage of the Hallstatt-limestone.

The narrow but open umbilicus is surrounded by a low spiral depression. This feature is one of the most characteristic and easily recognised in the examples of Alpine *Arcestes subumbilicati*. No furrows have been noticed where the cast is exposed underneath the shell. The specimen has a diameter of 95 mm.

Family : *CLADISCITIDÆ.*

Genus : CLADISCITES Mojsisovics.

1. CLADISCITES cf. NEORTUS v. Mojsisovics. Pl. XII, figs. 1, 2.

1873. *Cladiscites neortus* v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 78, Taf. XXX, fig. 2, Taf. XXXII, fig. 7.

Two specimens from the Tropites-limestone of Lilinthi (coll. Krafft) and Tera Gádh (coll. Smith) are very closely allied to *Cladiscites neortus* from the noric stage of the Hallstatt-limestone, from which they differ only by very subordinate details of the sutural line, which are probably accidental.

In the proportions of height and width of the cross section two species of the Hallstatt-limestone agree with *Cl. neortus* and might, consequently, put in a claim for comparison with our species. Those two species are *Cladiscites monticola* Mojsisovics (l. c., p. 78, Taf. XXX, fig. 5, and Supplement p. 282) and Cl. *crassestriatus* v. Mojsisovics (l. c., p. 79, Taf. XXX, fig. 4, and Supplementbd., p. 279).

In the sutural line of *Cladiscites monticola* the principal lateral saddle is the highest, whereas in the present form the sutural elements diminish regularly in height from the siphonal saddle down to the auxiliary saddles.

A distinction from *Cladiscites crassestriatus* is more difficult. The chief character in the sculpture of *Cladiscites crassestriatus* is the development of comparatively coarse spiral ribs on the lateral parts of the shell. My two specimens are casts with very few fragments of the shell adhering and as those fragments are confined to the siphonal area, nothing is known about the ornamentation of the flanks. In the ornamentation of the shell along the external part the difference between *Cl. neortus* and *Cl. crassestriatus* is less obvious. According to the diagnosis given by E. v. Mojsisovics, the latter species has the shell covered with very delicate spiral striæ or is even smooth along the external area. In my Himálayan specimens the fragments of the shell adhering to the siphonal area are distinctly striated. I consequently deem it preferable to refer them provisionally to *Cl. neortus*..

Dimensions.

Diameter of the shell		59	mm.
„ „ „ umbilicus		?	„
Height of the last volution	above the umbilical suture	35	„
	„ „ preceding whorl	20	„
Thickness of the last volution		30	„

Sutures.—The serial arrangement of the sutures proves our specimens to belong to *Cladiscites* (*sensu stricto*), not to *Hypocladiscites* (group of *Cladiscites subtornati*).

The siphonal saddle is situated entirely on the external area. Three lateral lobes and one auxiliary lobe are accessible to examination, but two more auxiliary lobes probably follow outside the umbilical suture.

The two halves of the siphonal saddle are unsymmetrical. The inner ramifications are larger than the outer ones. The only difference between *Cladiscites neortus* and my Indian type-specimen (fig. 2) consists in the broader development of the stems in all saddles, but this character is, perhaps, only due to a deeper grinding off of the surface of the cast. It only needs a glance at the sutures of *Cl. diuturnus*, as illustrated by E. v. Mojsisovics (l. c., Taf. XXXII, fig. 10) to see the difference in the stems of the saddles caused by grinding off the surface of the cast irregularly.

2 CLADISCITES sp. ind. aff. MOROSO Mojs. Pl. XII, fig. 3.

This type, which is represented in the Himálayan collection by a single entirely chambered specimen from Kalapani (coll. Smith), shows a great morphological resemblance to three European species, namely, *Cladiscites quadratus* Mojs. (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 76, Taf. XXVIII, fig. 3, XXXII, fig. 5), *Cl. morosus* Mojsisovics (*ibidem* p. 76, Taf. XXXII, fig. 3), and *Cl. pusillus* Mojsisovics (*ibidem* p. 77, Taf. XXVIII, fig. 4). From all of them it differs by its more compressed shape and by its high-mouthed cross section. The greatest width is attained by the whorls in the middle of their height.

The siphonal area is perfectly flat and separated from the regularly vaulted lateral parts by a bluntly rounded edge.

Dimensions.

Diameter of the shell		25	mm.
„ „ „ umbilicus		0	„
Height of the last volution	above the umbilical suture	15	„
	„ „ preceding whorl	9	„
Thickness of the last volution		11	„

Sutures.—The auxiliary series is not entirely accessible to examination, but from the position of the second auxiliary lobe, the presence of three auxiliary lobes outside the umbilicus appears highly probable. In this character the present species agrees with *Cladiscites morosus* from the noric stage of the Hallstatt-limestone, whereas *Cladiscites quadratus* and *Cl. pusillus* are distinguished by the presence of two auxiliary lobes only. From *Cl. pusillus* my Himálayan specimen differs moreover by the position of its principal lateral lobe, which is situated on the flank, not on the external area.

Family: *LOBITIDÆ.*

Genus: LOBITES Mojsisovics.

1. LOBITES sp. ind. cf. ELLIPTICUS Hauer. Pl. XV, figs. 8, 20.

1860. *Clydonites ellipticus* F. v. Hauer, *ex parte*, Nachtræge zur Kenntniss der Cephalopoden fauna der Hallstätter Schichten, Sitzgsber. Kais. Akad. d. Wiss. Wien, XLI. math. nat. Cl., p. 128, Taf. V, figs. 12—14 (*non* 8—11).

1873. *Lobites ellipticus* E. v. Mojsisovics, Die Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI, p. 161, Taf. LXVIII. figs. 17, 18; LXIX, figs. 1-3.

1902. *Lobites ellipticus* E. v. Mojsisovics, *ibidem* Supplement, p. 289.

Notwithstanding the difference in size between the figured specimen from the Tropites-limestone of Kalapani (coll. Krafft) and the European types of *Lobites ellipticus* from the middle carnic stage of the Hallstatt-limestone, I should not have hesitated to venture on a direct identification, had not slight deviations in some subordinate details been noticed. But in the genus *Lobites* such a narrow circumscription of species has been introduced by E. v. Mojsisovics, that a specific value is conceded to features, which in other genera of ammonites could only be regarded as of varietal importance. I must, consequently, be satisfied with referring my Himálayan examples to a species which is very closely allied to *L. ellipticus* but not exactly identical with it.

The figured specimen closely agrees with *Lobites ellipticus* in its general shape and cross-section. At the beginning of the last volution, which belongs entirely to the body-chamber, the shell is globose, with strongly inflated lateral parts and a rounded siphonal part. But in later stages of growth the transverse section gradually becomes lenticular, the lateral parts being flattened and the siphonal area narrow and steeply rounded, assuming the shape of a bluntly rounded edge.

The umbilicus is not entirely closed, as in typical specimens of *L. ellipticus.*

On the other hand the evolution of the apertural margin agrees exactly with that in the European species. The umbilical suture in leaving the normal spiral, unites with the apertural margin in a small, protracted lappet.

In its ornamentation my specimen also differs slightly from the typical *Lobites ellipticus*, its delicate transverse striæ being gently curved, with their concavity turned anteriorly, not straight and radial. In this character it agrees with

Lobites subellipticus Mojsisovics (l. c., p. 162, Taf. LXIX, fig. 4), which is, however, distinguished by more numerous and strongly marked striations or folds.

Dimensions.

Diameter of the shell		15 mm
„ „ „ umbilicus		0·5 „
Height of the last volution	above the umbilical suture	8 „
	„ „ preceding whorl	2 „
Thickness of the last volution		7·5 „

Sutures.—I have succeeded in developing the sutural line of a second specimen by scaling off its body-chamber volutions.

The sutures agree with those of *Lobites ellipticus* in most of the essential points. Five saddles stand outside the umbilical suture. The first and third saddles are the largest. The siphonal prominence is broad, but lower than the second saddle. I have not been able to notice the depression on its top, which has been described by E. v. Mojsisovics, the small size of my specimen not permitting the observation of such details. The siphonal lobe and the two following lobes stand at an equal level.

2. LOBITES sp. ind. (aff. PISUM Müust.?). Pl. XII, fig. 9.

From the Tropites-limestone of Kalapani (coll. Krafft) there is a single, small specimen of *Lobites*, which might perhaps be placed near *L. pisum* Münster (*vide* E. v. Mojsisovics, Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst., VI-1, p. 156, Taf. LXVIII, figs. 9, 11). Provided this determination were proved to be correct, it might be classed with the subgenus *Paralobites* Mojsisovics (l. c., Supplemented., p. 287). But the only specimen available to me for examination does not appear sufficient to enable me to come to a tolerably certain decision about its specific position.

The cast, which is provided with its body-chamber and mouth-margin, is globose, with strongly inflated whorls and a regularly rounded siphonal part. Its surface is perfectly smooth.

In contrast to *Lobites pisum* the shape of the last volution is not altered in the vicinity of the aperture. From the closed umbilicus the apertural margin is protracted radially in a straight line for a distance of 1 mm. where it becomes geniculated. From this spot, which corresponds to the small lateral lappet in the group of *Lobites ellipticus*, the margin describes a sigmoidal curve and unites with the anteriorly protracted lappet along the siphonal part.

Dimensions.

Diameter of the shell		11 mm.
„ „ „ umbilicus		0 „
Height of the last volution.	above the umbilical suture	6 „
	„ „ preceding whorl	2 „
Thickness of the last volution		7 „

Sutures.—Not known.

FAUNISTIC RESULTS.

In order to give a complete picture of the fauna of the Tropites-limestone of Byans all the species described in the text, which have been collected at Kalapani, Tera Gádh, Nihal, Lilinthi and Kuti by Smith and A. v. Krafft, are included in the following list.

Brachiopoda.

1. *Rhynchonella angulifrons* Bittn.

Gasteropoda.

2. *Loxonema* sp. ind.

Lamellibranchiata.

3. *Halobia cf. fascigera* Bittn.
4. „ *cf. comata* Bittn.
5. *Avicula sp. ind. aff. Tofanæ* Bittn.
6. „ *sp. ind. aff. caudata* Stopp.

Cephalopoda.

a. Dibranchiata.

7. *Atractites cf. ellipticus* Mojs.
8. „ *cf. convergens* Hauer.

b. Nautiloidea.

9. *Orthoceras cf. triadicum* Mojs.
10. „ *cf. dubium* Hauer.
11. „ *sp. ind.* (group of *O. striata*).
12. *Grypoceras sp. ind. aff. mesodico* Hauer.
13. *Proclydonautilus griesbachiformis* nov. sp.

c. Ammonoidea.

14. *Pinacoceras parma* Mojs.
15. „ *Metternichii* Hauer *var.*
16. „ *Beecheri* nov. sp.
17. „ *cf. rex.* Mojs.
18. *Placites polydactylus var. Oldhami* Mojs.
19. „ *sp. ind. ex aff. peraucti* Mojs.
20. *Bambanagites Kraffti* nov. sp.
21. *Carnites cf. floridus* Wulf.
22. *Megaphyllites jarbas* Münst.
23. *Discophyllites Ebneri* Mojs.
24. *Arcestes dicerus* Mojs.
25. „ *bicornis* Hauer.
26. „ *subbicornis* Mojs.
27. *Proarcestes cf. Gaytani* Klipst.

28. *Pararcestes nov. sp. ex aff. Zitteli* Mojs.
29. „ *cf. Sturi* Mojs.
30. „ *sp. ind. ex aff. sublabiato* Mojs.
31. *Stenarcestes nov. sp. ind. ex aff. polysphincto* Mojs.
32. „ *sp. ind. ex aff. subumbilicato* Bronn.
33. *Cladiscites cf. neortus* Mojs.
34. „ *sp. ind. aff. moroso* Mojs.
35. *Lobites sp. ind. cf. ellipticus* Hauer.
36. „ *sp. ind.* (*aff. pisum* Münst ?).
37. *Helictites cf. geniculato* Hauer.
38. „ *cf. subgeniculato* Mojs.
39. „ *sp. ind. aff. Beneckei* Mojs.
40. „ *Canningi* nov. sp.
41. *Phormedites fasciatus* Mojs.
42. „ *sp. ind. aff. juvavico* Mojs.
43. *Buchites cf. hilaris* Mojs.
44. „ *Emersoni* nov. sp.
45. *Thisbites Meleagri* Mojs.
46. „ *Ronaldshayi* nov. sp.
47. „ *Campbelli* nov. sp.
48. „ (*?*) *nov. sp. ind.*
49. *Parathisbites cf. scaphitiformis* Hauer.
50. „ *cf. Hyrtli* Mojs.
51. „ *Windhami* nov. sp.
52. „ *nodiger* nov. sp.
53. *Jellinekites* nov. gen. *Barnardi* nov. sp.
54. „ *Saundersi* nov. sp.
55. „ *Hoveyi* nov. sp.
56. *Arpadites Tassilo* Mojs.
57. *Dittmarites Rawlinsoni* nov. sp.
58. „ *sp. ind. ex. aff. Lilli* Gümb.
59. „ *Trailli* nov. sp.
60. „ *Trailliformis* nov. sp.
61. „ *Teragadhensis* nov. sp.
62. „ (*?*) *nov. sp. ind.*
63. *Trachypleuraspidites* nov. subgen. *Griffithi* nov. sp.
64. „ *Massoni* nov. sp.
65. *Steinmannites cf. Lubbocki* Mojs.
66. *Daphnites sp. ind. aff. Ungeri* Mojs.
67. *Dionites sp. ind. ex aff. Cæsar* Mojs.
68. *Drepanites sp. ind. ex aff. Marsyas* Mojs.
69. „ *Schucherti* nov. sp.
70. „ *Eastmani* nov. sp.
71. *Cyrtopleurites Freshfieldi* nov. sp.
72. „ *sp. ind. ex aff. Agrippinæ* Mojs.
73. *Tibetites cf. Ryalli* Mojs.
74. *Anatibetites Kelvini* Mojs.
75. „ *Hobsoni* nov. sp.

76. *Paratibetites Adolphi* Mojs.
77. „ *cf. Bertrandi* Mojs.
78. „ *cf. Geikiei* Mojs.
79. „ *sp. ind. aff Tornquisti* Mojs.
80. „ *Wheeleri* nov. sp.
81. *Acanthinites Hogarti* nov. sp.
82. *Himavatites* nov. subgen. *Watsoni* nov. sp.
83. *Polycyclus Henseli* Oppel.
84. *Clionites gracilis* nov. sp.
85. „ *sp. ind aff. Hughesii* Mojs.
86. „ *sp. ind. aff. aberrans* Mojs.
87. „ *Stauntoni* nov. sp.
88. „ *nov. sp. ind. ex aff. Dolloano* Mojs.
89. *Trachyceras nov. sp. ind.*
90. *Protrachyceras Ansoni* nov. sp.
91. „ *sp. ind.*
92. *Sandlingites Pearsoni* nov. sp.
93. „ *Tuckeri* nov. sp.
94. „ *cf. Oribasus* v. Dittm.
95. „ *sp. ind. ex aff. Archibaldi* Mojs.
96. *Sirenites trachyceratoides* nov. sp.
97. „ *sp. ind. ex aff Kohanyi* Mojs.
98. „ *Pamphagus* Dittm.
99. „ *Agriodus* Dittm.
100. „ *cf. Argonautæ* Mojs.
101. „ *sp. ind. ex aff. Argonautæ* Mojs.
102. „ *argonautæformis* nov. sp.
103. „ *cf. Dianæ* Mojs.
104. „ *Evæ* Mojs.
105. „ *Alixis* nov. sp.
106. „ *Vredenburgi* nov. sp.
107. „ *sp. ind. ex aff. Vredenburgi* Dien.
108. *Anasirenites cf. Menelaus* Mojs.
109. „ *Greeni* nov. sp.
110. *Distichites nov. sp. ind. aff. megacantho* Mojs.
111. „ *Sollasii* nov. sp.
112. „ *Falconeri* nov. sp.
113. „ *sp. ind. aff. celtico* Mojs.
114. „ *sp. ind. aff. Atropus* Dittm.
115. „ *cf. Harpalos* Dittm.
116. „ *sp. ind. aff. Minos* Mojs.
117. „ *Younghusbandi* nov. sp.
118. „ *sp. ind. aff. Younghusbandi* Dien.
119. „ *Reynoldsi* nov. sp.
120. „ *ectolcitiformis* nov. sp.
121. *Ectolcites Hollandi* nov. sp.
122. „ *arietiformis* nov. sp
123. „ *nov. sp. ind. aff. Hochstetteri* Mojs.
124. „ *Duncani* nov sp.

125. *Isculites Smithii* nov. sp.
126. ,, *Heimi* Mojs.
127. ,, *sp. ind. aff. obolino* Dittm.
128. *Halorites sp. ind. ex aff. procyon* Mojs.
129. *Jovites daciformis* nov. sp.
130. ,, *spectabilis* nov. sp.
131. *Gonionotites Gemmellaroi* nov. sp.
132. *Parajuravites Jacquini* Mojs
133. *Anatomites speciosus* nov. sp.
134. ,, *cf. crasseplicatus* Mojs.
135. ,, *cf. Fischeri* Mojs.
136. ,, *sp. ind. aff. Fischeri* Mojs.
137. ,, *Beresfordi* nov. sp.
138. ,, *cf. Theodori* Mojs.
139. ,, *cf. Edgari* Mojs.
140. *Didymites tectus* Mojs.
141. ,, *sp. ind. aff. Quenstedti* Mojs.
142. ,, *sp. ind. aff. subglobus* Mojs.
143. ,, *Kitchini* nov. sp.
144. *Sibirites (Metasibirites?) Philippii* nov. sp.
145. *Eutomoceras Kraffti* nov. sp.
146. ,, *Mojsisovicsi* nov. sp.
147. ,, *cf. sandlingense* Hauer.
148. *Margarites cf. auctus* Dittm.
149. ,, *Sushena* nov. sp.
150. ,, *nov. sp. ind. aff aucto* Dittm.
151. ,, *cf. circumspinatus* Mojs.
152. ,, *Georgii* Mojs.
153. ,, *sp. ind. aff. Georgii* Mojs.
154. ,, *Devasena* nov. sp.
155. *Tropites subbullatus* Hauer.
156. ,, *cf. fusobullatus* Mojs.
157. ,, *cf. discobullatus* Mojs.
158. ,, *cf. Estellae* Mojs.
159. ,, *Manasa* nov. sp.
160. ,, *Wodani* Mojs.
161. ,, *cf. Paracelsi* Mojs.
162. ,, *Jalandhara* nov. sp.
163. ,, *sp. ind. aff acutangulo* Mojs.
164. ,, *kalapanicus* Mojs.
165. *Anatropites nihalensis* nov. sp.
166. ,, *margaritiformis* nov. sp.
167. *Paratropites lilinthicus* nov. sp.
168. *Tropiceltites arietitoides* nov. sp.

There are, on the whole, 168 forms known up to the present time from the horizon. Not less than 155 species, that is to say an overwhelming majority, are ammonites. The Tropites-limestone of Byans may consequently be termed a cephalopod-bearing facies with full reason. In no other Triassic horizon of the Himálayas—if perhaps we except the Halorites beds of the Bambanag range—does the most characteristic feature consist in an equal predominance of the class of Cephalopoda.

The fauna of the Tropites-limestone of Byans is extraordinarily rich in species. There are few horizons in the Alpine Trias and none in extra-Alpine territories which surpass it in this respect. From the Himálayan Muschelkalk 118 species (90 ammonites), from the Halorites-limestone 62 species (55 ammonites) have been described hitherto. Both horizons are consequently inferior to the Tropites-limestone of Byans in the richness of their faunæ.

Among 155 species of ammonites 102 are peculiar to the Tropites-limestone of Byans and only 53 are identical with species from the Halorites-limestone of the Himálayas or from the Triassic Hallstatt-limestone of the Eastern Alps. But among the new species a very large percentage are very nearly allied to European forms, whereas the number of faunistic elements, which impart to the Indian Triassic province the character of a zoogeographical region of its own, is less considerable.

Among those faunistic elements peculiar to the Tropites-limestone of Byans must be mentioned those which take the first rank :—The strange genus *Jellinekites*, whose systematic position is as yet doubtful, the new subgenus *Trachypleuraspidites*, which is certainly allied to *Dittmarites* Mojs., but shows remarkable morphological affinities to *Trachyceras*; the subgenus *Himavatites*, in which characters of *Acanthinites*, *Sagenites* and *Trachyceras* are united; the group of *Sirenites Vredenburgi* Dien., an isolated type of the genus *Sirenites*, distinguished by its very delicate sculpture, thin, thread-like ribs, and transversely elongated tubercles. As species representing types, which differ widely from Alpine forms, I have to mention here :—*Drepanites Schucherti* and *Dr. Eastmani*, differing completely from the *Drepanites* of the Mediterranean Triassic province; *Clionites gracilis*, the only species of the genus with a narrow umbilicus; *Distichites ectolcitiformis*, a transitional shape between the genera *Distichites* and *Ectolcites*; *Tropiceltites arietitoides* of remarkable similarity with liassic *Arietidæ*; *Anatropites margaritiformis*, which recalls the genus *Margarites* in its external characters.

The relations with upper Triassic faunæ of the Mediterranean region are most clearly indicated by the occurrence of numerous identical or very closely allied forms in the two areas. But the assemblage of those species in the Tropites limestone of Byans is very peculiar and exhibits rather conflicting characters.

Among the species identical or very closely allied with those of the upper Triassic rocks of the Eastern Alps a large number points to the *carnic* stage, especially to an age approximately equal to that of the Subbullatus beds of the Salzkammergut. In Griesbach's little collection from Kalapani, containing ten species of ammonites altogether, all the elements represented pointed to the carnic stage. Their examination led E. v. Mojsisovics to the following conclusion :—"I consider the Tropites-limestone of Kalapani as the exact homotaxial equivalent of the tuvalic Tropites-limestone of the Mediterranean province. There exists in both cases not only the same association of general but also close specific relationship, which in a better state of preservation of the specimens might perhaps have led to the identification of some forms with European species." (Himál. Foss. Vol. III, Pt. 1, p. 130.)

The carnic type of the fauna shows itself in the following list of ammonites :—

Buchites cf. hilaris Mojs.
Arpadites Tassilo Mojs.
Polycyclus Henseli Oppel.
Trachyceras sp. ind.
Sandlingites cf. Oribasus Dittm.
Sirenites sp. aff. Kohányi Mojs.[1]
„ *Pamphagus* Dittm.
„ *Agriodus* Dittm.
Anasirenites cf. Menelaus Mojs.
Isculites Heimi Mojs.
„ *sp. aff. obolino* Dittm.[2]
Jovites daciformis Diener.[3]
„ *spectabilis* Diener.[4]
Anatomites cf. crasseplicatus Mojs.
„ *cf. Theodori* Mojs.
„ *cf. Edgari* Mojs.
„ *cf. Fischeri* Mojs.
Eutomoceras cf. sandlingense Hauer.
Margarites cf. circumspinatus Mojs.
„ *cf. auctus* Dittm.
„ *Georgii* Mojs.
Tropites subbullatus Hauer.
„ *cf. fusobullatus* Mojs.
„ *cf. discobullatus* Mojs.
„ *cf. Estellæ* Mojs.
„ *sp. ind. aff. acutangulo* Mojs.
„ *Wodani* Mojs.
„ *cf. Paracelsi* Mojs.
Pinacoceras cf. rex Mojs.
Placites sp. ind. ex aff. perauct̃i Mojs.[5]
Megaphyllites Jarbas Münst.
Carnites cf. floridus Wulf.
Discophyllites Ebneri Mojs.
Arcestes bicornis Hauer.
Proarcestes cf. Gaytani Klipst.
Pararcestes cf. Sturi Mojs.
Lobites sp. ind. cf. ellipticus Hauer.

Very nearly allied to the true *S. Kohanyi* from the julic (middle-carnic) substage of the Salzkammergut.

[2] Differing from *I. obolinus* only by insignificant details in the arrangement of the sutural line.

[3] Very nearly allied to *Jovites dacus* Mojs.

[4] Very nearly allied to *J. bosnensis* Mojs. In the European Trias the sub-genus *Jovites* is entirely restricted to beds of carnic age.

[5] Probably identical with a species from the carnic Daonella beds of the Central Himálayas.

As faunistic elements pointing to a carnic age of the Tropites-limestone of Byans we find also:—two species of the subgenus *Protrachyceras*, three species of the subgenus *Thisbites*, two species of the genus *Eutomoceras* and one species of the genus *Gonionotites*. Although the specific similarities of those elements with European types are rather distant, they can be brought forward in favour of a carnic age, because no representatives of those four genera or sub-genera have in Europe been found in beds younger than the carnic stage.

The typical carnic habit of the faunistic elements enumerated is chiefly marked by the presence of twelve genera or sub-genera, which are restricted to the carnic stage of the Mediterranean province and do not there extend into the noric stage. These genera or sub-genera are *Thisbites, Arpadites, Trachyceras, Protrachyceras, Jovites, Gonionotites, Eutomoceras, Anatropites, Carnites, Proarcestes, Pararcestes, Lobites.*

To the carnic elements of the fauna all species of *Lamellibranchiata* and *Dibranchiata* must be added which are either identical with, or nearly related to Indian species from the Daonella beds (*Halobia cf. fascigera, H. cf. comata* Bittn.) or with European forms (*Avicula aff. Tofanæ, A. aff. caudata, Atractites cf. convergens, A. cf. ellipticus*).

The relationship to the carnic stage is, as can be easily seen, manifold. The majority of faunistic elements contained in the preceding lists points to the zone of *Tropites subbullatus* (tuvalic substage). But there are also relations with the julic fauna of the zone of *Trachyceras aonoides*. In the list quoted above there are altogether 28 species of ammonites, which have been directly identified with European species or referred to such as "*cf.*" Among them 9 belong to the julic, 16 to the tuvalic sub-stage and 3 are common to both sub-stages. It is evident from this proportion that the greater number of relationships and analogies are in favour of a correlation with the tuvalic sub-stage.

The circumstance that *Trachyceras* and *Protrachyceras* have up to the present time been stated to occur only in beds older than the tuvalic Tropites-limestone of the Alpine region in Europe, cannot influence the determination of the age, as the genus *Trachyceras*, which in Europe appears for the last time in the zone of *Trachyceras Aonoides* has been found in the Tropites beds of California, of undoubtedly tuvalic age, by J. Perrin Smith.[1] Especially those groups of carnic elements, which give to the fauna its peculiar type and are conspicuous for their specific fecundity, such as *Tropites, Margarites, Anatomites*, are found in the tuvalic sub-stage of the Hallstatt-limestone.

Notwithstanding these striking affinities of the fauna of the Tropites-limestone of Byans to that of the Subbullatus zone of the Hallstatt limestone, the question of its age becomes very complicated if we examine the second faunistic element, which is equally distributed in the Tropites-limestone. This element consists of species and genera of ammonites characteristic of the *noric* stage of the Mediterranean province.

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[1] *J. Perrin Smith:* The metamorphic series of Shasta County, California, American Journ. of Geology, Vol. II, p. 607. Mesozoic changes in faunal geography of California, *ibid.* Vol. III, p. 377.

The species of ammonites bearing the stamp of a noric age are contained in the following list :—

Helictites cf. geniculato Mojs.
,, *cf. subgeniculato* Mojs.
,, *sp. ind. aff. Beneckei* Mojs.[1]
Phormedites fasciatus Mojs.
,, *sp. aff Juvavico* Mojs.
Parathisbites cf. scaphitiformis Hauer.
,, *cf. Hyrtli* Mojs.
Steinmannites cf. Lubbocki Mojs.
Daphnites sp. aff. Ungeri Mojs.
Dionites sp. ind. aff. Cæsar Mojs.
Drepanites sp. ind. aff. Marsyas Mojs.
Cyrtopleurites sp. ind. aff. Agrippinæ Mojs.
Tibetites cf. Ryalli Mojs.
Anatibetites Kelvini Mojs.
Paratibetites Adolphi Mojs.
,, *cf. Bertrandi* Mojs.
,, *cf. Geikiei* Mojs.
Acanthinites Hogarti Diener.[2]
Distichites cf. Harpalos Dittm.
Sirenites cf. Argonautæ Mojs.
,, *cf. Dianæ* Mojs.
,, *Evæ* Mojs.
Halorites sp. ind. aff. procyon Mojs.
Parajuvavites Jacquini Mojs.
Ectolcites sp. ind. aff. Hochstetteri Mojs.
Didymites tectus Mojs.
Pinacoceras parma Mojs.
,, *Metternichii var.* Hauer.
Bambanagites Kraffti Diener.
Arcestes dicerus Mojs.
Stenarcestes aff. polysphincto Mojs.
,, *aff. subumbilicato* Bronn.
Cladiscites cf. neortus Mojs.

To this list must be added six species of the group of ***Distichites megacanthi***, which in the Hallstatt-limestone is entirely restricted to beds of noric age, two species of ***Drepanites***, two species of ***Parathisbites***, three species of ***Ectolcites***, three species of ***Didymites***—all genera of exclusively noric age. Thus the number of species of ammonites in the Tropites-limestone of Byans pointing to a noric age is raised to 49, or one-third of the entire number of species. To the types characteristic of the noric stage belong the genera or sub-genera : ***Phormedites***,

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[1] Very nearly allied to *H. Beneckei* of ladic age.

[2] Nearly allied to *A. excelsior* Mojs. of sevatic age.

Parathisbites, Steinmannites, Daphnites, Dionites, Drepanites, Tibetites, Anatibetites, Paratibetites, Acanthinites, Parajuvavites, Halorites, Ectoloites, Didymites, Bambanagites, Stenarcestes, which have as yet never been found in beds of carnic age. The genus ***Didymites*** especially, one of the leading fossils of the Tropites-limestone of Byans at all localities from which collections have been made by Smith and A. v. Krafft, is restricted in Europe to the alaunic (middle noric) substage.

The cephalopod fauna of the Tropites-limestone of Byans has, as the above analysis shows, relations with both the carnic and noric faunæ of the Hallstatt-limestone. Thus the detailed examination of the rich materials entrusted to me for description fully corroborates the views expressed by A. v. Krafft in his official report. He was the first to draw attention to a remarkable mixture of two different elements in the fauna of the Tropites-limestone, one of them with carnic, the other with noric affinities.

Such an assemblage of forms has never been met with in any Triassic horizon of the Eastern Alps, where noric and carnic faunæ are invariably found concentrated in entirely different deposits. It remains therefore to enquire how this strange fact may be satisfactorily explained.

The easiest explanation would be to suggest that the two faunæ have been mixed accidentally in the collections from different localities. Those palæontologists who are familiar with the stratigraphical features of the Hallstatt-limestone, will be ready to admit a mixing of two different horizons, which, although lithologically identical, contain two different faunæ and are consequently of different age. It would be in accordance with this assumption, if we could state from the data available for our examination, that each of the two faunæ of the Tropites-limestone were concentrated at a different locality and not mixed there with the other fauna.

In the following list the ammonites of this horizon have been enumerated with respect to the localities, where they were collected; * indicates species with carnic affinities, † those with noric affinities :—

Kalapani.

* *Buchites cf. hilaris* Mojs.
* *Thisbites Meleagri* Mojs.
† *Parathisbites nodiger* Dien.
*† *Dittmarites sp. ind.*
† *Daphnites sp. ind. aff. Ungeri* Mojs.
† *Drepanites sp. ind. ex aff. Marsyas* Mojs
† *Anatibetites Hobsoni* Dien.
† *Paratibetites Wheeleri* Dien.
† *Acanthinites Hogarti* Dien.
* *Polycyclus Henseli* Opp.
Clionites gracilis Dien.
† „ *sp. ind. aff. aberrans* Mojs.
* „ *sp. aff. Dolloano* Mojs.
* *Trachyceras sp. ind.*
* *Protrachyceras Ausoni* Dien.

Sandlingites Pearsoni Diener.
† „ *sp. ind. aff. Archibaldi* Mojs.
* *Sirenites Pamphagus* Dittm.
* „ *Agriodus* Dittm.
„ *Vredenburgi* Dien.
* *Anasirenites cf. Menelaus* Mojs.
„ *Greeni* Dien.
† *Distichites sp. ind. aff. celtico* Mojs.
„ *sp. ind. aff. Younghusbandi* Dien.
„ *Reynoldsi* Dien.
„ *ectolcitiformis* Dien.
† *Ectolcites nov. sp. ind. aff. Hochstetteri* Mojs.
† „ *Duncani* Dien.
† *Halorites sp. ind. aff. procyon* Mojs.
* *Jovites daciformis* Dien.
* „ *spectabilis* Dien.
* *Gonionotites Gemmellaroi* Dien.
Sibirites (*Metasibirites ?*) *Philippii* Dien.
* *Anatomites cf. crasseplicatus* Mojs.
* „ *cf. Theodori* Mojs.
* „ *Beresfordi* Dien.
* „ *cf. Fischeri* Mojs.
* „ *sp. ind. aff. Fischeri* Mojs.
* „ *cf. Edgari* Mojs.
* *Eutomoceras Kraffti* Dien.
* „ *Mojsisovicsi* Dien.
* „ *cf. Sandlingense* Hauer.
* *Tropites subbullatus* Hauer.
* „ *cf. fusobullatus* Mojs.
* „ *cf. discobullatus* Mojs.
* „ *cf. Estellæ* Mojs.
* „ *Manasa* Dien.
* „ *Wodani* Mojs.
* „ *cf. Paracelsi* Mojs.
„ *Jalandhara* Dien.
* „ *sp. aff. acutangulo* Mojs.
„ *Kalapanicus* Mojs.
* *Margarites cf. auctus* Dittm.
„ *Sushena* Dien.
* „ *nov. sp. aff. aucto* Dittm.
* „ *cf. circumspinatus* Mojs.
* „ *Georgii* Mojs.
* „ *sp. ind. aff. Georgii* Mojs.
„ *Devasena* Dien.
* *Anotropites margaritiformis* Dien.
* „ *nihalensis* Dien.
• *Tropiceltites arietitoides* Dien.
† *Didymites tectus* Mojs.

† *Didymites sp. ind. aff. Quenstedti* Mojs.
† „ *sp. ind. aff. subglobus* Mojs.
† „ *Kitchini* Dien.
*† *Placites polydactylus var. Oldhami* Mojs.
* *Discophyllites Ebneri* Mojs.
† *Arcestes dicerus* Mojs.
† „ *bicornis* Hauer.
* *Proarcestes cf. Gaytani* Klipst.
* *Pararcestes nov. sp. aff. Zitteli* Mojs.
† *Stenarcestes nov. sp. ex aff. polysphincto* Mojs.
† „ *sp. ind. aff. subumbilicato* Bronn.
Cladiscites sp. ind. aff. moroso Mojs.
* *Lobites sp.* (*aff. pisum* Münst ?).
* „ *sp. cf. ellipticus* Hauer.

Kuti.

* *Thisbites nov. sp. ind.*
* *Gonionotites sp. ind.*
† *Ectolcites Duncani* Dien.
*† *Placites polydactylus var. Oldhami* Mojs.
* *Pararcestes cf. Sturi* Mojs.
Arcestes sp. ind.

Tera Gádh.

Helictites Canningi nov. sp.
† „ *cf. subgeniculatus* Mojs.
† „ *sp. ind. aff. Beneckei* Mojs.
† *Phormedites fasciatus* Mojs.
† „ *sp. ind. aff. juvavico* Mojs.
Buchites Emersoni nov. sp.
* *Thisbites Meleagri* Mojs.
„ *Ronaldshayi* nov. sp.
„ *Campbelli* nov. sp.
† *Parathisbites cf. scaphitiformis* Hauer.
† „ *cf. Hyrtli* Mojs.
„ *Wyndhami* nov. sp.
* *Arpadites Tassilo* Mojs.
Dittmarites Rawlinsoni nov. sp.
† „ *sp. ind. aff. Lilli* Guemb.
„ *Trailli* nov. sp.
„ *Trailliformis* nov. sp.
„ *Teragadhensis* nov. sp.
Trachypleuraspidites Griffithi Dien.
† *Steinmannites cf. Lubbocki* Mojs.
† *Dionites sp. ind. aff. Cæsar* Mojs.
Cyrtopleurites Freshfieldi nov. sp.
† *Anatibetites Kelvini* Mojs.

† *Paratibetites Adolphi* Mojs.
† *Acanthinites Hogarti* Dien.
Himavatites Watsoni nov. sp.
Clionites gracilis nov. sp.
† „ *sp. ind. aff. Hughesii* Mojs
„ *Stauntoni* Dien.
* *Protrachyceras sp. ind.*
Sandlingites Tuckeri Dien.
* „ *cf. Oribasus* Dittm.
Sirenites trachyceratoides Dien.
* „ *sp. ind. aff. Kohányi* Mojs.
† „ *cf. Argonautæ* Mojs.
† „ *sp. ind. aff. Argonautæ* Mojs.
† „ *Argonautæformis* nov. sp.
† „ *cf. Dianæ* Mojs.
† „ *Evæ* Mojs.
„ *Alixis* nov. sp.
† *Distichites Sollasii* nov. sp.
† „ *Falconeri* Dien.
† „ *sp. ind. aff. celtico* Mojs.
† „ *sp. ind. aff. atropus* Dittm.
„ *Younghusbandi* Dien.
† *Ectolcites Duncani* nov. sp.
† „ *sp. ind. aff. Hochstetteri* Mojs.
* *Isculites Heimi* Mojs.
* „ *sp. ind. aff. obolino* Dittm.
„ *Smithii* nov. sp.
† *Parajuvavites Jacquini* Mojs.
* *Tropites subbullatus* Hauer.
* *Margarites cf. circumspinatus* Mojs.
„ *Devasena* Dien.
† *Didymites tectus* Mojs.
† *Pinacoceras Metternichii* Hauer, var.
* „ *cf. rex* Mojs.
„ *Beccheri* nov. sp.
*† *Placites polydactylus var. Oldhami* Mojs.
* *Arcestes bicornis* Hauer.
* „ *subbicornis* Mojs.
* *Megaphyllites jarbas* Münst.

Nihal.

† *Helictites cf. geniculato* Hauer.
† *Paratibetites sp. ind. aff. Tornquisti* Mojs.
† *Ectolcites Duncani* nov. sp.
† *Distichites sp. ind. aff. Minos* Mojs.
* *Anatomites speciosus* Dien.
* *Anatropites nihalensis* Dien.
*† *Placites polydactylus var. Oldhami* Mojs.

Lilinthi.

* *Thisbites Meleagri* Mojs.
* „ *Ronaldshayi* Dien.
Jellinekites Barnardi Dien.
„ *Saundersi* Dien.
„ *Hoveyi* Dien.
Trachypleuraspidites Griffithi nov. sp.
„ *Massoni* nov. sp.
† *Drepanites Schucherti* Dien.
† „ *Eastmani* Dien.
Cyrtopleurites Freshfieldi Dien.
† „ *sp. aff. Agrippinæ* Mojs.
† *Tibetites cf. Ryalli* Mojs.
† *Anatibetites Kelvini* Mojs.
† *Paratibetites cf. Bertrandi* Mojs.
† „ *Wheeleri* Dien.
Sandlingites Pearsoni nov. sp.
„ *Tuckeri* nov. sp.
Sirenites sp. ind. aff. Vredenburgi Dien.
† *Distichites nov. sp. ind. ex aff. megacantho* Mojs.
† „ *cf. Harpalos* Dittm.
† *Ectolcites Hollandi* Dien.
† „ *arietiformis* nov. sp.
† „ *Duncani* Dien.
* *Tropites kalapanicus* Mojs.
Paratropites (?) lilinthicus nov. sp.
† *Didymites tectus* Mojs.
† *Pinacoceras parma* Mojs.
*† *Placites polydactylus var. Oldhami* Mojs.
* „ *sp. ind. aff. perancto* Mojs.
† *Bambanagites Kraffti* nov. sp.
* *Carnites cf. floridus* Wulf.
* *Discophyllites Ebneri* Mojs.
* *Pararcestes sp. ind. aff. sublabiato* Mojs.
† *Cladiscites cf. neortus* Mojs.

It is evident from these lists that the noric and carnic faunæ do not occur at separate localities but are amalgamated in the Tropites-limestone at every locality at which collections have been made. Thus we are led to the conclusion that two faunæ, which in the Alpine Trias are known to characterise two horizons of different geological age, have in Byans been found mixed together in one single bed of only three feet in thickness.

It is a well-known fact that in the Alpine Trias there is no greater gap in the development of faunæ than between the noric and carnic stages.

"Between the carnic and noric stage"—E. v. Mojsisovics states (Cephalopoden der Hallstätter Kalke, Abhandl. K. K. Geol. Reichsanst, VI-2, p. 822)—"a break in the sequence of faunæ must be suggested. Not one single species of ammonites passes from one stage into the other; even in the genera and sub-genera common to both stages there are gaps in the evolution, not bridged over by transitional types."

The question arises, whether this strange assemblage of elements with noric and carnic affinities in the fauna of the Tropites-limestone of Byans might not constitute a transitional fauna bridging over the hiatus which exists between the noric and carnic stage in the Trias of the Eastern Alps. If this suggestion could be proved to be correct, the Tropites beds of Byans might be considered as passage beds from the tuvalic (upper carnic) to the lacic (lower noric) substage.

The supposition that the fauna of the Tropites-limestone of Byans might just fit into the break of succession, which in the Alpine Trias has been assumed between the faunæ of the carnic and noric stages by E. v. Mojsisovics, is not confirmed by any facts. The Tropites-limestone is very poor in such faunistic elements as might be regarded as transitional forms connecting the two faunæ. One single species of ammonite, *Placites polydactylus*, is common to both stages. The typical form is of lacic age, whereas the variety *Oldhami* has been found in the Daonella beds of Lauka of julic age. As connecting links between the two faunæ we may cite the species of the subgenus *Dittmarites* (*Arpadites rimosi*) which are very nearly allied to *D. Lilli* Guemb. on the one hand and to the carnic *D. Dorceus* on the other. Another connecting link is *Buchites Emersoni* nov. sp., uniting characters of the carnic sub-genus *Buchites* and of the noric sub-genus *Phormedites*. But this is a very small number compared with the large number of ammonites confined either to the carnic or noric stage of the Alpine Trias and of which they are characteristic.

There is still a further consideration, which leads to the conclusion that the fauna of the Tropites-limestone is not the fauna of a passage-bed between the carnic and noric stages. Among the species of ammonites identical or very nearly allied with those of the carnic stage, two different sets can be distinguished, one with julic and the other with tuvalic affinities. In the noric elements of the fauna similar relations with both the lacic and alaunic sub-stages are obvious. There is undoubtedly a preponderance of lacic affinities in them, but the relationship to the alaunic stage is nevertheless very remarkable. Among those elements, which in the Trias of the Eastern Alps are, according to our present knowledge, confined to the alaunic sub-stage, the genera *Ectolcites* and *Didymites* may be noticed, especially the latter, which is one of the commonest leading fossils of the Tropites-limestone of Byans at all localities at which collections were made by Smith and A. v. Krafft.

A fauna with so strange a mixture of julic, tuvalic, lacic and alaunic types does not exhibit a truly transitional character. In the fauna of a passage-bed between the tuvalic and lacic sub-stages we should expect an overwhelming preponderance of exclusively tuvalic and lacic types and of transitional links connecting them, especially of such species as might be considered the direct ancestors of lacic forms. Nothing of this kind is seen in the fauna of the Tropites-limestone.

From all this it appears that the Tropites beds of Byans cannot be considered as a passage-bed from the carnic to the noric stage on palæontological grounds and that the strange mixture of two faunæ in this horizon must be explained otherwise.

This strange mixture agrees in a remarkable manner with the association of Kelloway and Oxford ammonites in the Jurassic oolites of Balin (Galicia). As has been proved by Neumayr (Abhandl. K. K. Geol. Reichsanst. Wien V, 1871) the oolite of Balin contains in a very thin bed 66 species of Jurassic ammonites of Kelloway and Oxford age, extending from the zone of *Oppelia aspidoides* to the zone of *Quenstedtoceras Lamberti*. It would be in contradiction with our knowledge of the distribution of Jurassic ammonites to suggest that two faunæ, which in all other parts of the world have been found confined to geologically different horizons, had lived together at the same period in the sea in which the oolites of Balin were deposited. As in analogous cases the want of sediment seems to be the cause of the mixture of the Kelloway and Oxford types at Balin.

There is especially one fact in favour of a similar explanation of the association of carnic and noric faunæ in the Tropites-limestone of Byans. This is the strong affinity which the noric fauna of this horizon shows to that of the Halorites-limestone of the Bambanag section. The following nine species are identical or probably identical with species from the Halorites beds :—

Steinmannites cf. Lubbocki Mojs.
Tibetites cf. Ryalli Mojs.
Anatibetites Kelvini Mojs.
Paratibetites Adolphi Mojs.
  „ *cf. Bertrandi* Mojs.
  „ *cf. Geikiei* Mojs.
Halorites sp. aff. procyon Mojs
Parajuvavites Jacquini Mojs.
Pinacoceras parma Mojs.

As elements pointing to a close relation with the fauna of the Halorites-limestone we may cite also :—

Clionites sp. ind. aff. Hughesii Mojs.
  „ *sp. ind. aff. aberrans* Mojs.
Sandlingites sp. ind. aff. Archibaldi Mojs.
Bambanagites Kraffti nov. sp.

It is especially the genus *Tibetites* which plays an important part in the fauna of the Tropites-limestone and is barely less numerously represented than the carnic types of *Tropites* from which the horizon has taken its denomination.

Taking all this into consideration it appears probable that the Tropites-limestone of Byans is not only a homotaxial equivalent of the tuvalic sub-stage in Europe, but also an equivalent of the Haucrites beds and Halorites beds of lacic age[1] of the

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[1] The absence of any equivalents of the Hauerites beds would not necessarily involve the suggestion of a faunistic hiatus, the independence of the Hauerites beds as a palæontological horizon not having been established with full certainty. The fauna of the Hauerites beds is certainly of lacic age, but is too poor in species to decide whether it really does or does not correspond to an independent palæontological zone.

Himálayas of Johar and Painkhanda. The intimate connection of the two sub-stages might be explained by the want of sediment during the tuvalic and lacic periods. With this suggestion the remarkable reduction in the thickness of Triassic sediments from Spiti to Byans would be well in accordance. The lacic stage which in Spiti amounts to approximately 300 feet, dwindles down in the sections of the Bambanag and Shalshal cliffs to such an insignificant thickness, that Griesbach and myself failed to discover it, and the existence of a hiatus between the beds of Muschelkalk and of carnic age was even suggested by E. v. Mojsisovics in consequence.

The case might be similar with regard to the association of carnic and noric faunæ in the Tropites-limestone of Byans. Let us suppose that during the tuvalic and lacic periods a bed of lithologically uniform character, only three feet in thickness, had been deposited, it would become impossible to distinguish the equivalents of the Alpine Tropites beds and of the Indian Halorites beds in the sections.

It is only by new observations in the field, that the correctness of this suggestion can be proved. Smith and A. v. Krafft have failed to discover any fossiliferous horizon above the Tropites-limestone. A. v. Krafft in his official report (*vide* Introduction) is inclined to look for equivalents of the Halorites beds in bed 5 of his section near Kalapani (shales with undeterminable ammonites), but he himself confesses his inability to say anything definite about the probable correlation of the upper Triassic beds. If the Halorites-limestone should, indeed, be discovered in the series of Triassic rocks following above the grey shales on the top of the Tropites-limestone (bed 8 Smith, bed 3 Krafft), then, but only then, my arguments in favour of a correlation of the Tropites-limestone of Byans with both the Tropites beds of the Eastern Alps and with the Halorites beds of the Himálayas would fall to the ground.

I have endeavoured to separate as strictly as possible the facts from their explanation.

The assemblage of two different faunæ, one with carnic the other with noric affinities, in the Tropites-limestone of Byans is a fact which has been established with full certainty on palæontological evidence. This fact is incongruous with a homotaxis of the Tropites-limestone of Byans with the tuvalic Tropites-limestone of Europe, as had been supposed by E. v. Mojsisovics.

Different explanations of this fact might be attempted.

Transitional links between the two faunæ being almost entirely absent, the Tropites-limestone of Byans cannot be considered as a true passage-bed from the carnic to the noric stage.

I am rather inclined to accept the following mode of explanation.

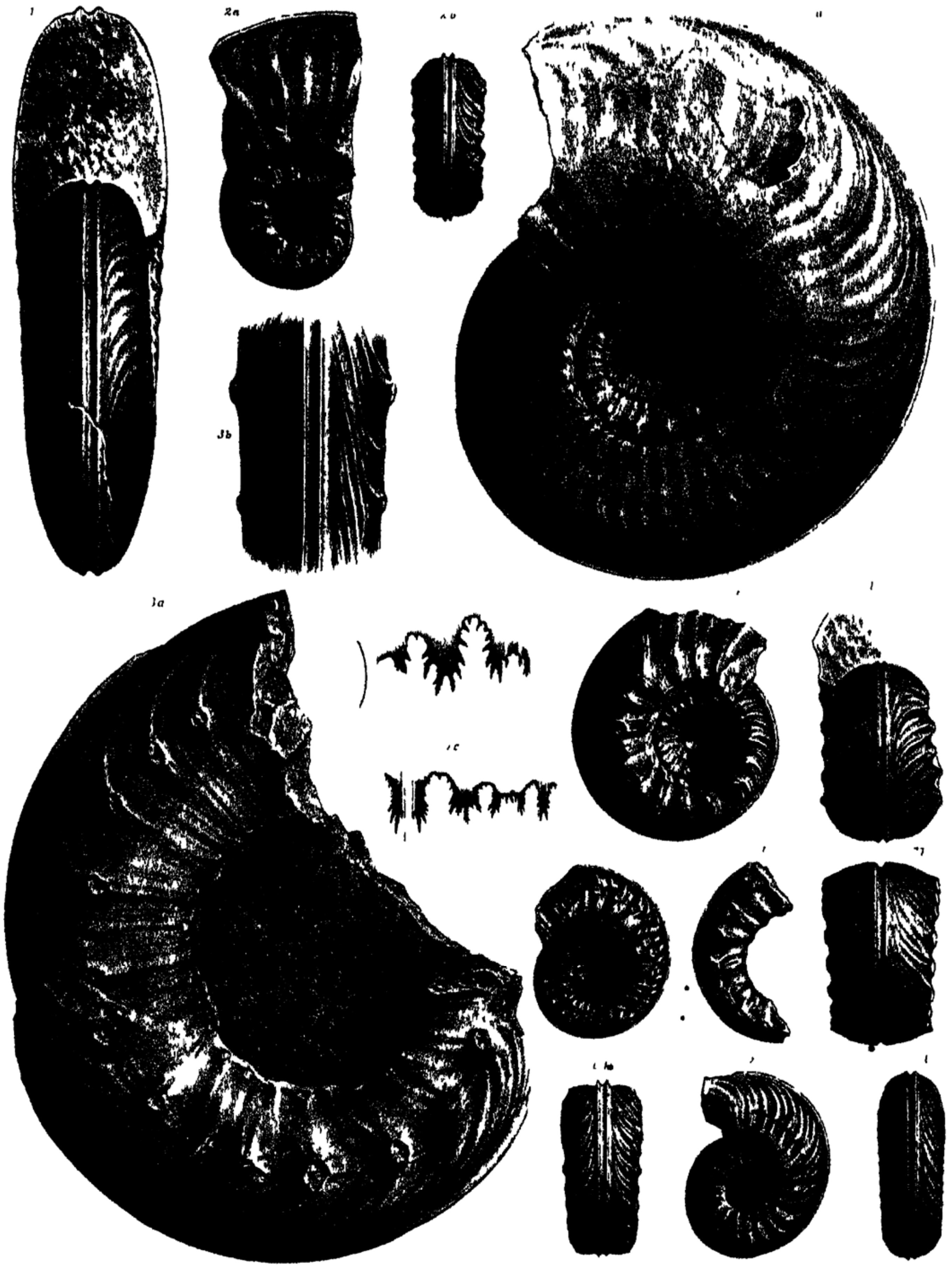
Assuming a very small amount of sedimentation, during the tuvalic and lacic periods in the sections of Byans, I should consider hte Tropites-limestone as a homotaxial equivalent of the tuvalic and lacic substages. Thus this bed of fossiliferous limestone of three feet in thickness would correspond in age to the whole group composed of the topmost Daonella beds, the Hauerites and Halorites beds of the Bambanag section. The want of sediment would be the real cause of the fecundity of this thin bed in ammonites with relations to two faunæ, which in the Triassic Hallstatt limestone of the Alps have as yet always been found in distinct horizons of different geological ages.

My explanation has some probability of correctness, but it will remain, I regret to say, uncertain, until a detailed survey of the country has led to the discovery of fossiliferous horizons in the upper Trias of Byans, which forbid a correlation of any Triassic rock-group overlying the Tropites limestone with the Halorites beds of Painkhanda and Johár.

PLATE I.

Fig. 1*a*, *b*, *c*. DISTICHITES SOLLASI Diener. Tera Gádh, coll. Smith.
„ 2*a*, *b*. „ FALCONERI Diener „ „ „ „
„ 3*a*, *b*. „ NOV. SP. AFF. MEGACANTHO Mojs. Lilinthi, coll. Smith.
„ 4*a*, *b*. „ SP. IND. AFF. CELTICO Mojs. Tera Gádh, coll. Smith.
„ 5*a*, *b*. „ CF. HARPALOS v. Dittmar. Lilinthi, coll. Smith.
„ 6*a*, *b*. „ SP. IND. AFF. ATROPUS v. Dittmar. Tera Gádh, coll. Smith.
„ 7*a*, *b*, *c*. MARGARITES CF. CIRCUMSPINATUS Mojs. Tera Gádh, coll. Smith.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



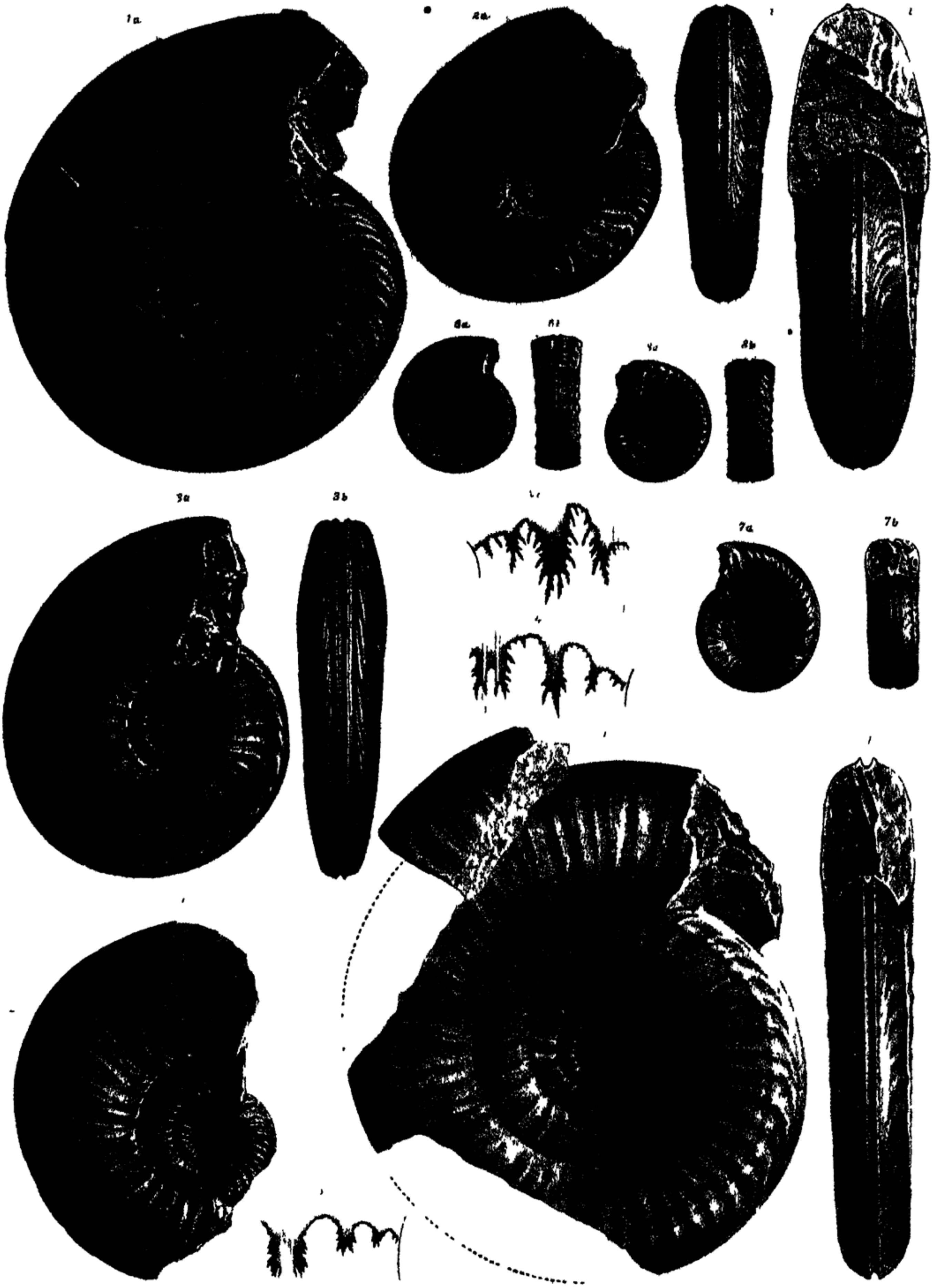
R Mayer del et lith

Albert Berger print

PLATE II.

Fig. 1*a*, *b*. DISTICHITES YOUNGHUSBANDI Diener. Tera Gádh, coll Smith.
„ 2*a*, *b*, *c*. „ „ , „ „ Krafft.
„ 3*a*, *b*. „ REYNOLDSI Diener Kalapani, coll. Smith.
„ 4*a*, *b* „ ECTOLCITIFORMIS Diener Kalapani, coll Krafft.
„ 5*a*, *b*, *c*. ECTOLCITES HOLLANDI Diener Lilinthi, coll. Krafft.
„ 6*a*, *b*. „ ARIETIFORMIS Diener , „ „
„ 7*a*, *b*. „ DUNCANI Diener *var*. Kalapani, coll. Smith.
„ 8*a*, *b*. „ SP. IND. AFF. HOCHSTETTERI, Mojs. Kalapani, coll. Smith

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



R Mayer del et lith

Albert Berger print

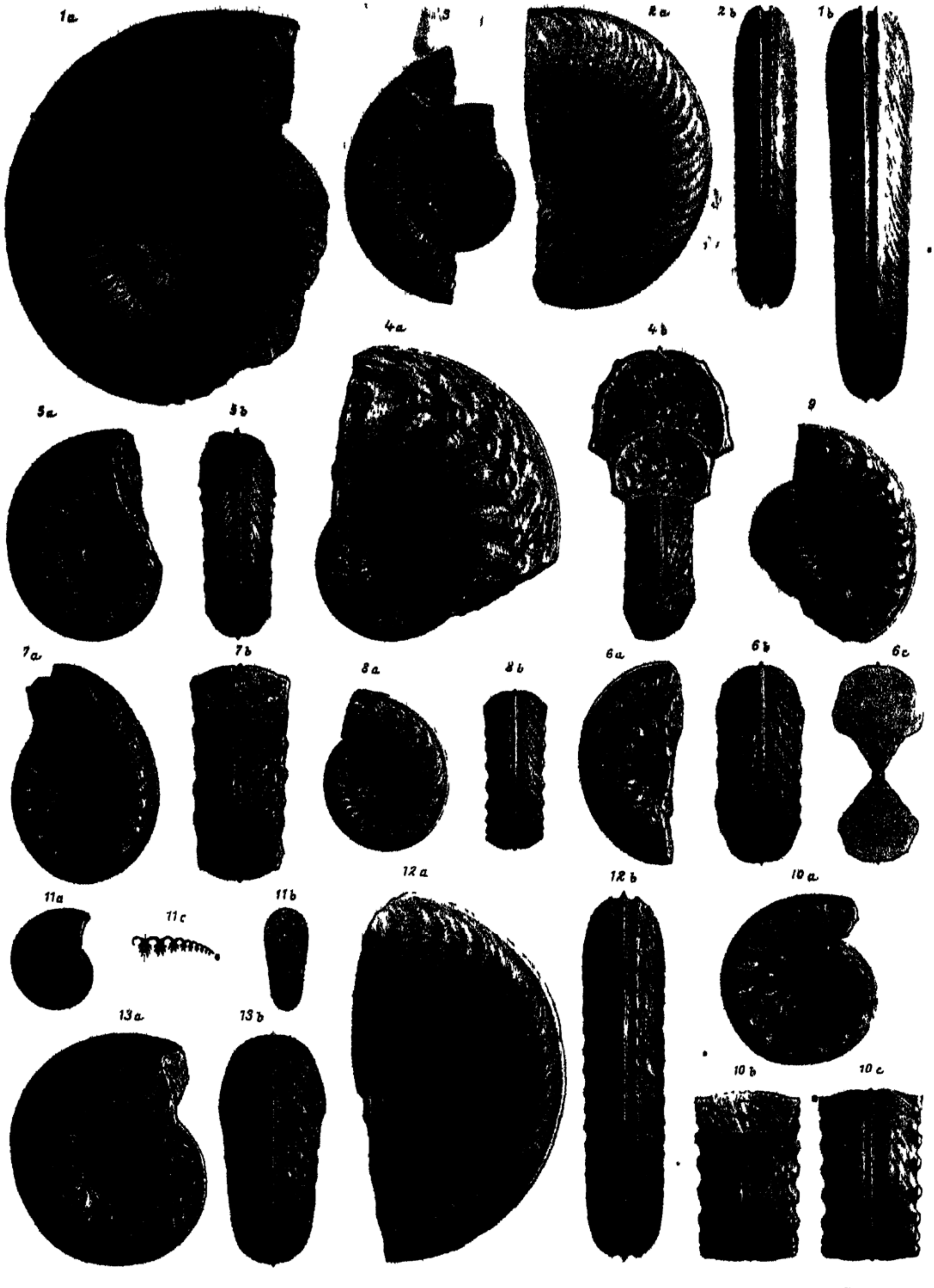
PLATE III.

Fig. 1*a*, *b*. ECTOLCITES DUNCANI Diener. Tera Gádh, coll. Smith.
" 2*a*, *b*. " " " Kalapani " "
" 3. " " " Lilinthi " "
" 4*a*, *b*. MARGARITES CF. AUCTUS Dittm. Kalapani, coll. Smith.
" 5*a*, *b*. " SUSHENA Diener. " " "
" 6*a*, *b*, *c*. " NOV. SP. IND. EX AFF. AUCTO Dittm. Kalapani, coll. Smith.
" 7*a*, *b*. " CF. CIRCUMSPINATUS Mojs. Kalapani, coll. Smith.
" 8*a*, *b*. " GEORGII Mojs. Kalapani, coll. Smith.
" 9. " NOV. SP. IND. AFF. GEORGII Mojs. Kalapani, coll. Smith.
" 10*a*, *b*, *c*. " DEVASENA Diener. Kalapani, coll. Smith.
" 11*a*, *b*, *c*. MEGAPHYLLITES JARBAS Muenst. Tera Gádh, coll. Krafft.
" 12*a*, *b*. TROPICELTITES ARIETITOIDES Diener. Kalapani, coll. Smith.
" 13*a*, *b*. ANATROPITES MARGARITIFORMIS Diener. " " "

Geol. Surv. of India.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA).

Pl. III.



R Mayer del. et lith

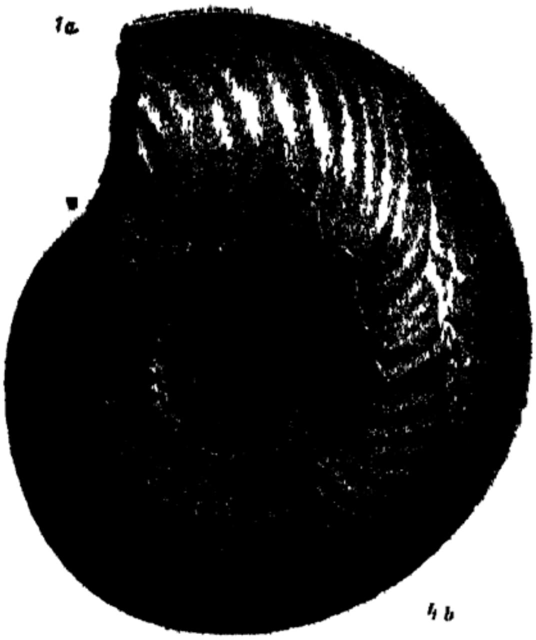
Albert Berger print

PLATE IV.

Fig. 1*a*, *b*. TROPITES CF. DISCOBULLATUS Mojs. Kalapani, coll. Smith.
,, 2*a*, *b*. ,, MANASA Diener. Kalapani, coll. Krafft.
,, 3*a*, *b*. ,, CF. ESTELLÆ Mojs. Kalapani, coll. Smith.
,, 4*a*, *b*. ,, JALANDHARA Diener. ,, ,, ,,
,, 5*a*, *b*. ,, CF. PARACELSI Mojs. ,, ,, ,,
,, 6*a*, *b*. ,, SUBBULLATUS Hauer, inner nucleus. Kalapani, coll. Smith.
,, 7*a*, *b*. ,, ,, ,, full-grown individual. Tera Gádh, coll. Krafft.
,, 8*a*, *b*. ANATROPITES NIHALENSIS Diener. Nihal, coll. Smith.
,, 9*a*, *b*. ,, ,, ,, ,, ,, ,,

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)

1a



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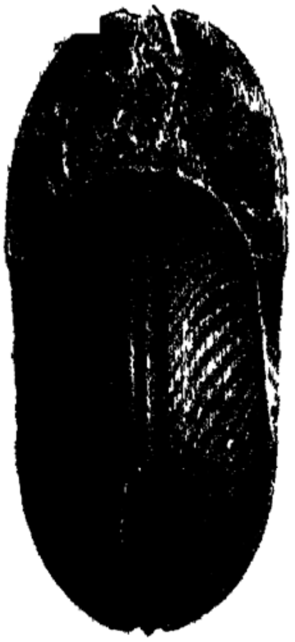

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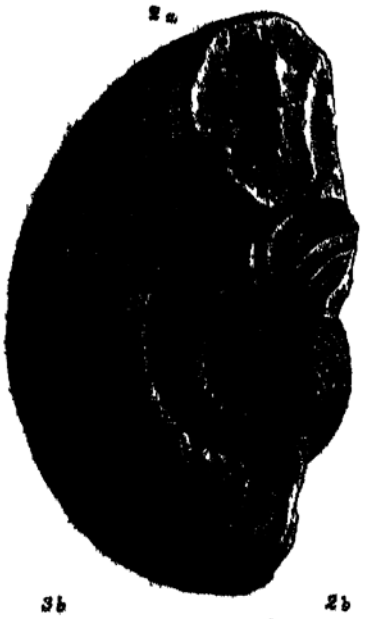

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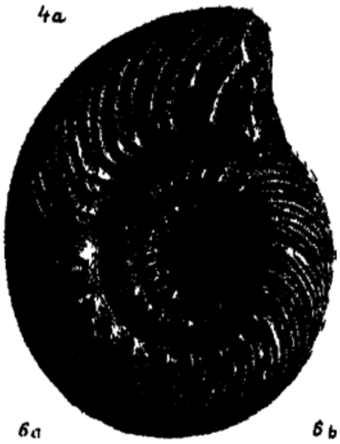

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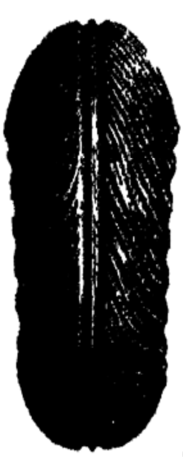

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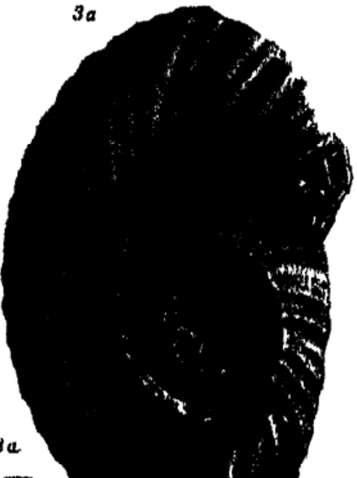

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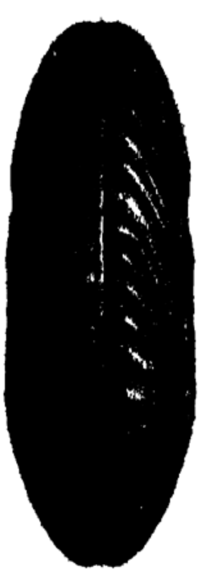

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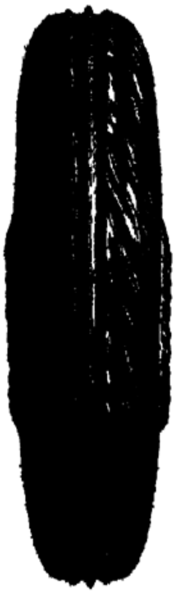

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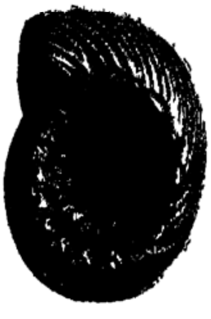

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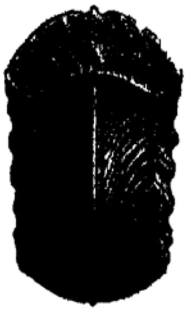

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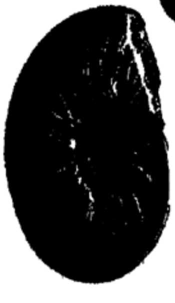

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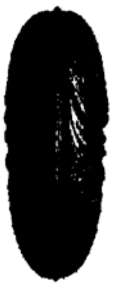
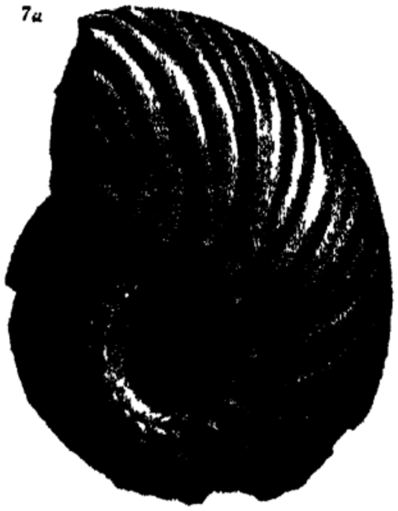


9a

9b

7a



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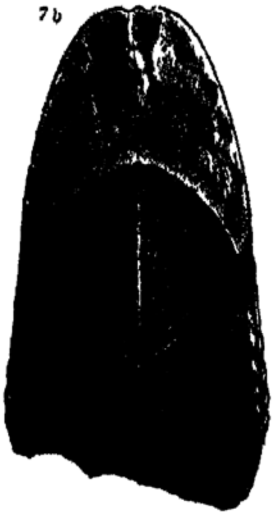

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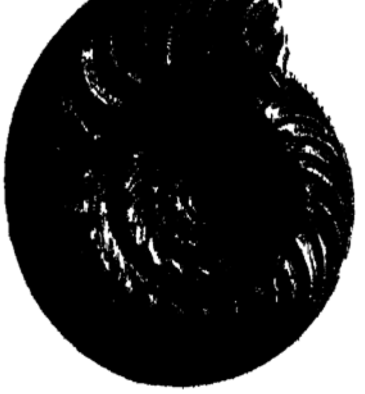

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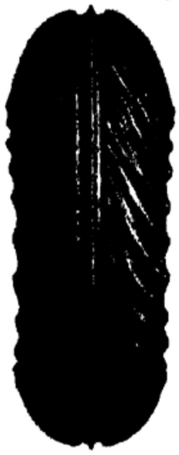


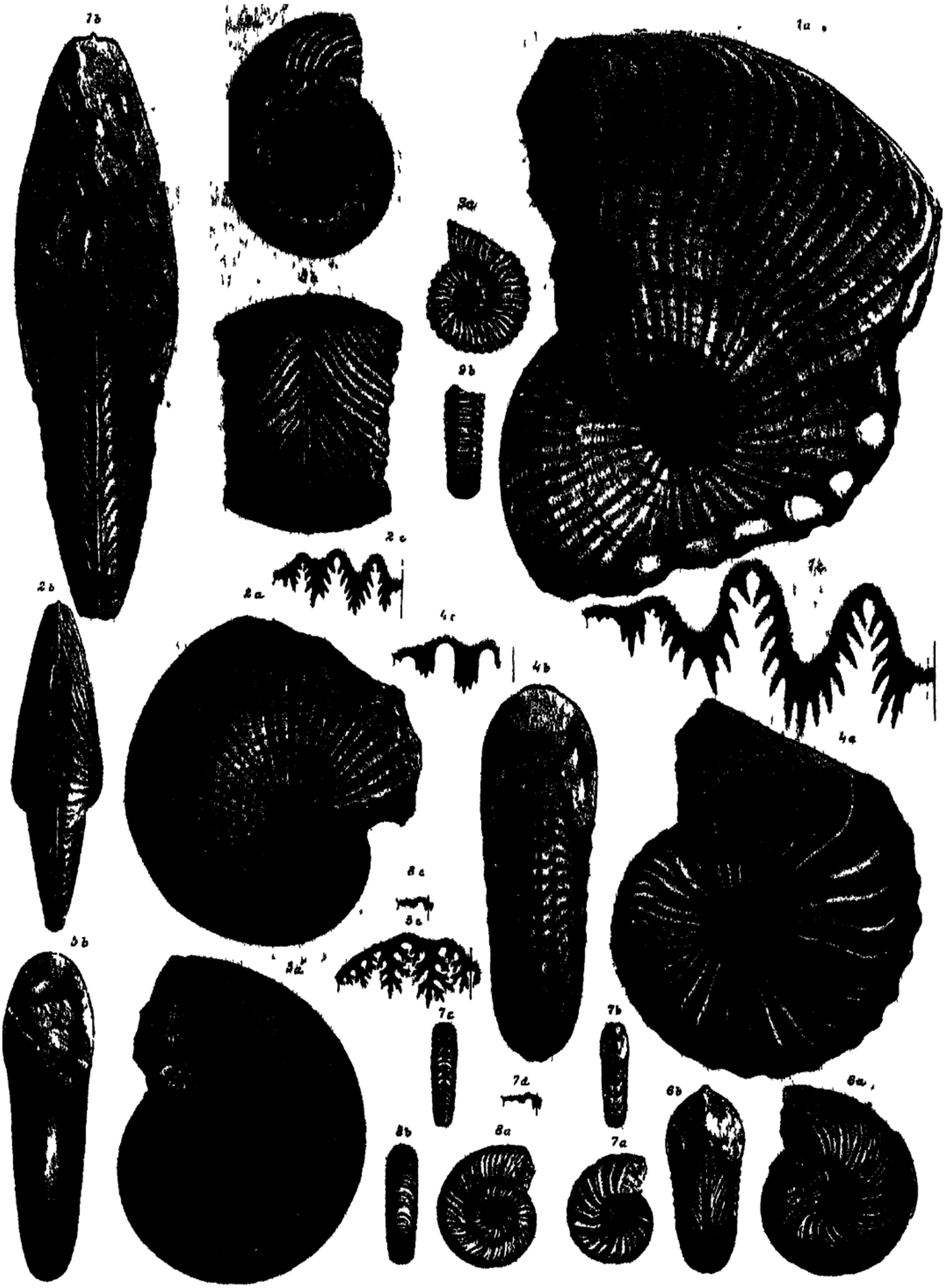
R Mayer del et lith

Albert Berger print

PLATE V.

Fig. 1*a*, *b*, *c*.	Eutomoceras Kraffti Diener.	Kalapani, coll. Krafft.
,, 2*a*, *b*, *c*.	,, Mojsisovicsi Diener.	Kalapani, coll. Smith.
,, 3*a*, *b*.	Tropites cf. fusobullatus Mojs.	,, ,, ,,
,, 4*a*, *b*, *c*.	Steinmannites cf. Lubbocki Mojs.	Tera Gádh, coll. Krafft.
,, 5*a*, *b*, *c*.	Discophyllites Ebneri Mojs	Lilinthi, coll Krafft.
,, 6*a*, *b*.	Tropites Wodani Mojs.	Kalapani, coll. Smith.
,, 7*a*, *b*, *c*, *d*.	Phormedites fasciatus Mojs.	Tera Gádh, coll. Smith.
,, 8*a*, *b*, *c*	Buchites Emersoni Diener	,, ,, ,, ,,
,, 9*a*, *b*	Sandlingites sp. ind aff. Archibaldi Mojs	Kalapani, coll. Smith.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



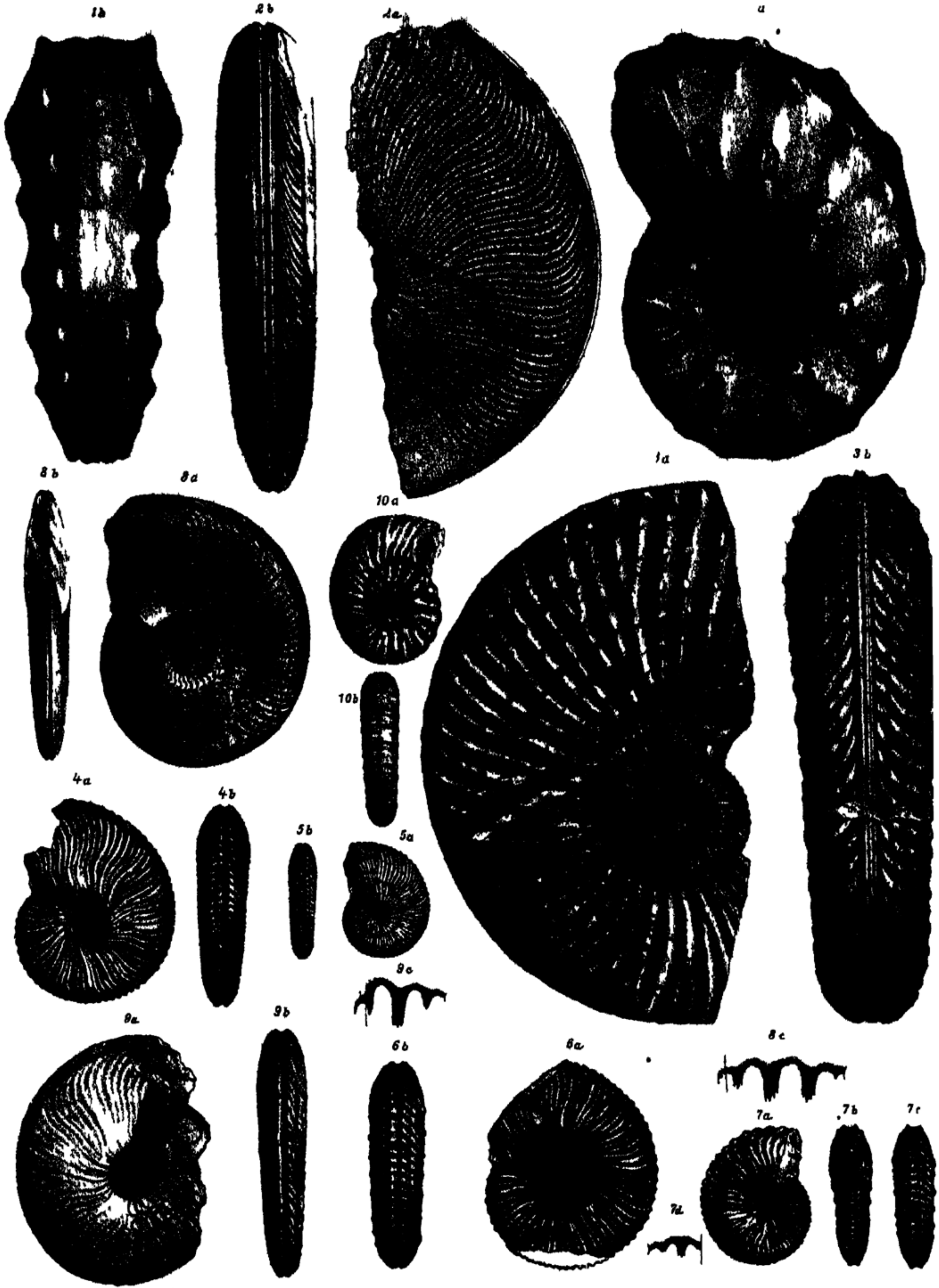
A Swoboda del et lith

Albert Berger print

PLATE VI.

Fig. 1*a*, *b*. Anatibetites Hubsoni Diener. Kalapani, coll. Krafft.
„ 2*a*, *b*. Dittmarites sp. ind. aff. Lilli Guembel. Tera Gádh, coll. Smith.
„ 3*a*, *b*. Trachypleuraspidites Griffithi Diener. „ „ „ „
„ 4*a*, *b* Sandlingites Pearsoni Diener. Lilinthi, coll. Smith.
„ 5*a*, *b*. Clionites gracilis Diener. Kalapani, coll. Krafft.
„ 6*a*, *b*. Sandlingites Tuckeri Diener. Lilinthi, coll. Smith.
„ 7*a*, *b*, *c*, *d*. Sandlingites cf. Oribasus v. Dittmar. Tera Gádh, coll. Smith.
„ 8*a*, *b*, *c*. Drepanites Schucherti Diener. Lilinthi, coll. Krafft.
„ 9*a*, *b*, *c*. „ Eastmani Diener. „ „ „
„ 10*a*. *b*' Helictites Canningi Diener. Tera Gádh, coll. Smith.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



A Swoboda del et lith

Albert Berger print

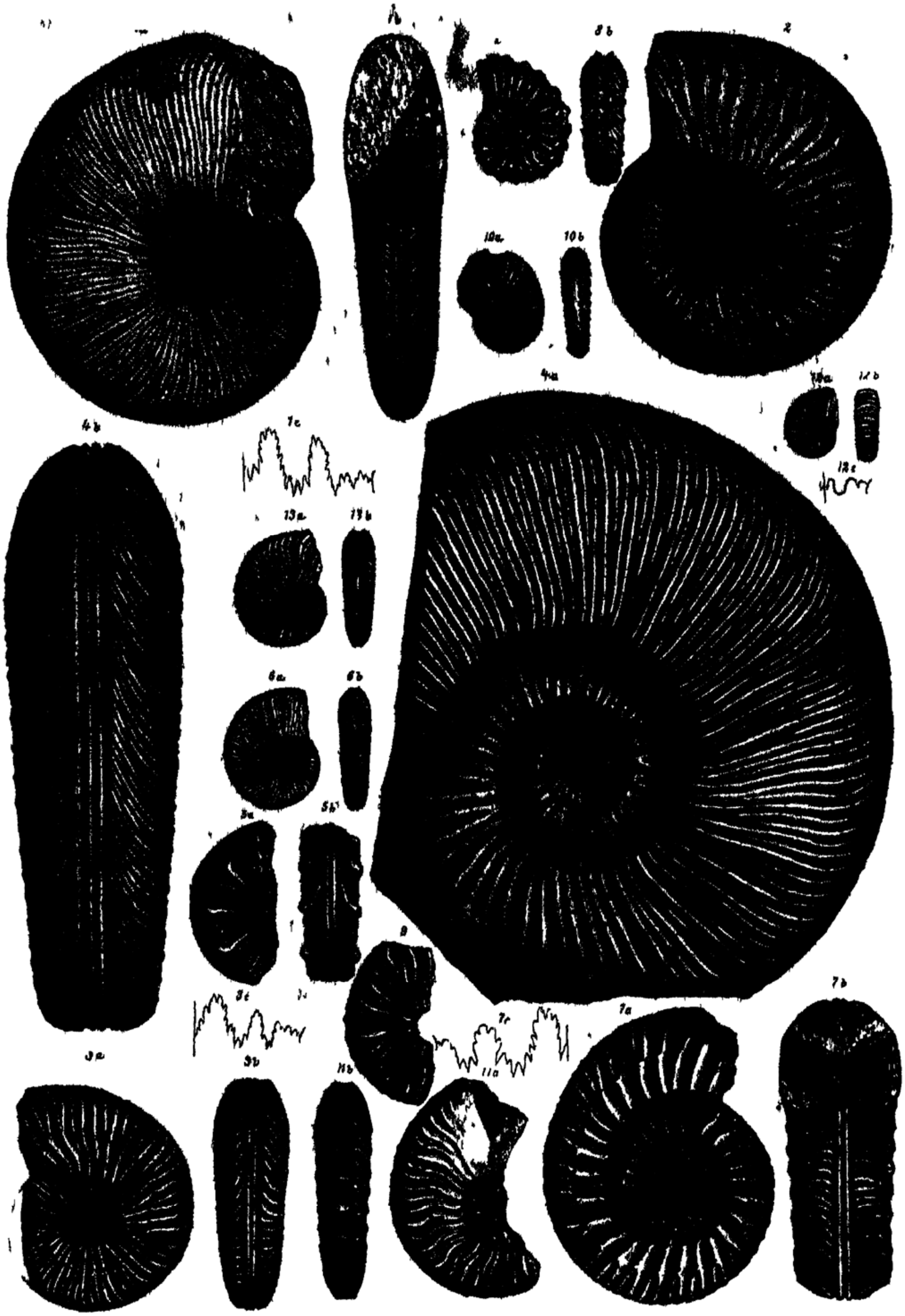
PLATE VII.

Fig. 1*a*, *b*, *c*. DITTMARITES TRAILLI Diener. Tera Gádh, coll. Smith.
„ 2. „ TRAILLIFORMIS Diener. Tera Gádh, coll. Smith.
„ 3*a*, *b*, *c*. „ „ „ „ „ „ „
„ 4*a*, *b*. „ RAWLINSONI Diener. „ „ „ „
„ 5*a*, *b*. „ NOV. SP. IND. Kalapani, coll. Krafft.
„ 6*a*, *b*. ARPADITES TASSILO v. Mojsisovics. Tera Gádh, coll. Smith.
„ 7*a*, *b*, *c*. TRACHYPLEURASPIDITES MASSONI Diener. Lilinthi, coll. Krafft.
„ 8*a*, *b*. CLIONITES STAUNTONI Diener. Tera Gádh, coll. Smith.
„ 9. „ SP. IND. AFF. HUGHESII v. Mojsisovics. Tera Gádh, coll. Smith.
„ 10*a*, *b*. „ NOV. SP. IND. EX AFF. DOLLOANO Mojs. Kalapani, coll. Krafft.
„ 11*a*, *b*. „ SP. IND. AFF. ABERRANS Mojsisovics. Kalapani, coll. Krafft.
„ 12*a*, *b*, *c*. POLYCYCLUS HENSELI Oppel. Kalapani, coll. Krafft.
„ 13*a*, *b*. CLIONITES GRACILIS Diener. Tera Gádh, coll. Krafft.

Geol. Surv. of India.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)

Pl VII



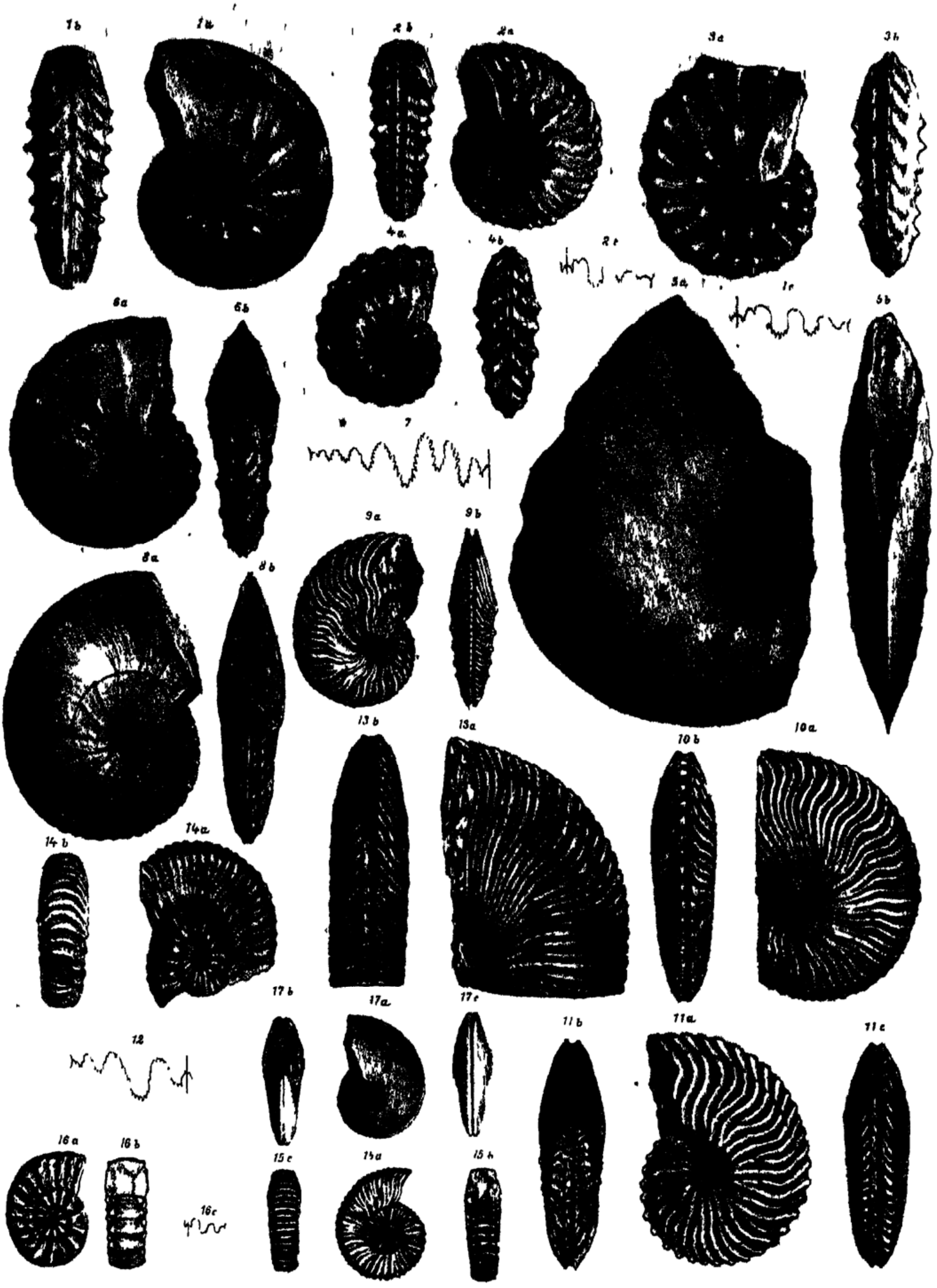
A. Swoboda del et lith

Albert Berger print

PLATE VIII.

Fig. 1*a*, *b*, *c*. **ANATIBETITES KELVINI** Mojsisovics. Tera Gádh, coll. Smith.
" 2*a*, *b*, *c*. " " " Lilinthi, coll. Krafft.
" 3*a*, *b*, *c*. " CF. **BERTRANDI** Mojsisovics. Lilinthi, coll. Krafft.
" 4*a*, *b*. **TIBETITES** CF. **RYALLI** Mojsisovics. Lilinthi, coll. Krafft.
" 5*a*, *b*. **PARATIBETITES WHEELERI** Diener. Kalapani, coll. Krafft.
" 6*a*, *b*. " " " Lilinthi, coll. Krafft.
" 7. " " " Sutural line. Lilinthi, coll. Krafft.
" 8*a*, *b*. " **ADOLPHI** Mojsisovics. Tera Gádh, coll. Smith.
" 9*a*, *b*. **CYRTOPLEURITES FRESHFIELDI** Diener. Lilinthi, coll. Krafft.
" 10*a*, *b*. " " " Tera Gádh, coll. Smith.
" 11*a*, *b*, *c*. " " " Lilinthi, coll. Krafft.
" 12. " " " (Sutural line). Tera Gádh, coll. Smith.
" 13*a*, *b*. " SP. IND. EX AFF. **AGRIPPINÆ** Mojs. Lilinthi, coll. Krafft.
" 14*a*, *b*. **HELICTITES** SP. IND. AFF. **BENECKEI** Mojs. Tera Gádh, coll. Smith.
" 15*a*, *b*, *c*. " CF. GENICULATO v. Hauer. " " " "
" 16*a*, *b*, *c*. " CF. SUBGENICULATO v. Mojsisovics. " " " "
" 17*a*, *b*, *c*. **DREPANITES** SP. IND. EX AFF. **MARSYAS** Mojs. Kalapani, coll. Krafft.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA).



A. Swoboda del. et lith.

Albert Berger print.

PLATE IX.

Fig. 1*a*, *b*. Acanthinites Hogarti Diener. Tera Gádh, coll. Smith.

„ 2*a*, *b*. „ (Himavatites) Watsoni Diener. Inner volutions of the specimen illustrated on Pl. XI, fig. 1. Tera Gádh, coll. Krafft.

„ 3*a*, *b*, *c*. Acanthinites Hogarti Diener. Kalapani, coll. Krafft.

„ 4*a*, *b*. Sirenites trachyceratoides Diener Tera Gádh, coll. Smith.

„ 5*a*, *b* *c*. „ Evæ v. Mojsisovics. Tera Gádh, coll. Krafft.

„ 6. „ Agriodus v. Dittmar. Kalapani, coll. Krafft.

„ 7*a*, *b*. „ sp. ind. aff. Argonautæ Mojs. Tera Gádh, coll. Krafft.

„ 8*a*, *b*. „ cf. Argonautæ Mojsisovics. Tera Gádh, coll. Smith.

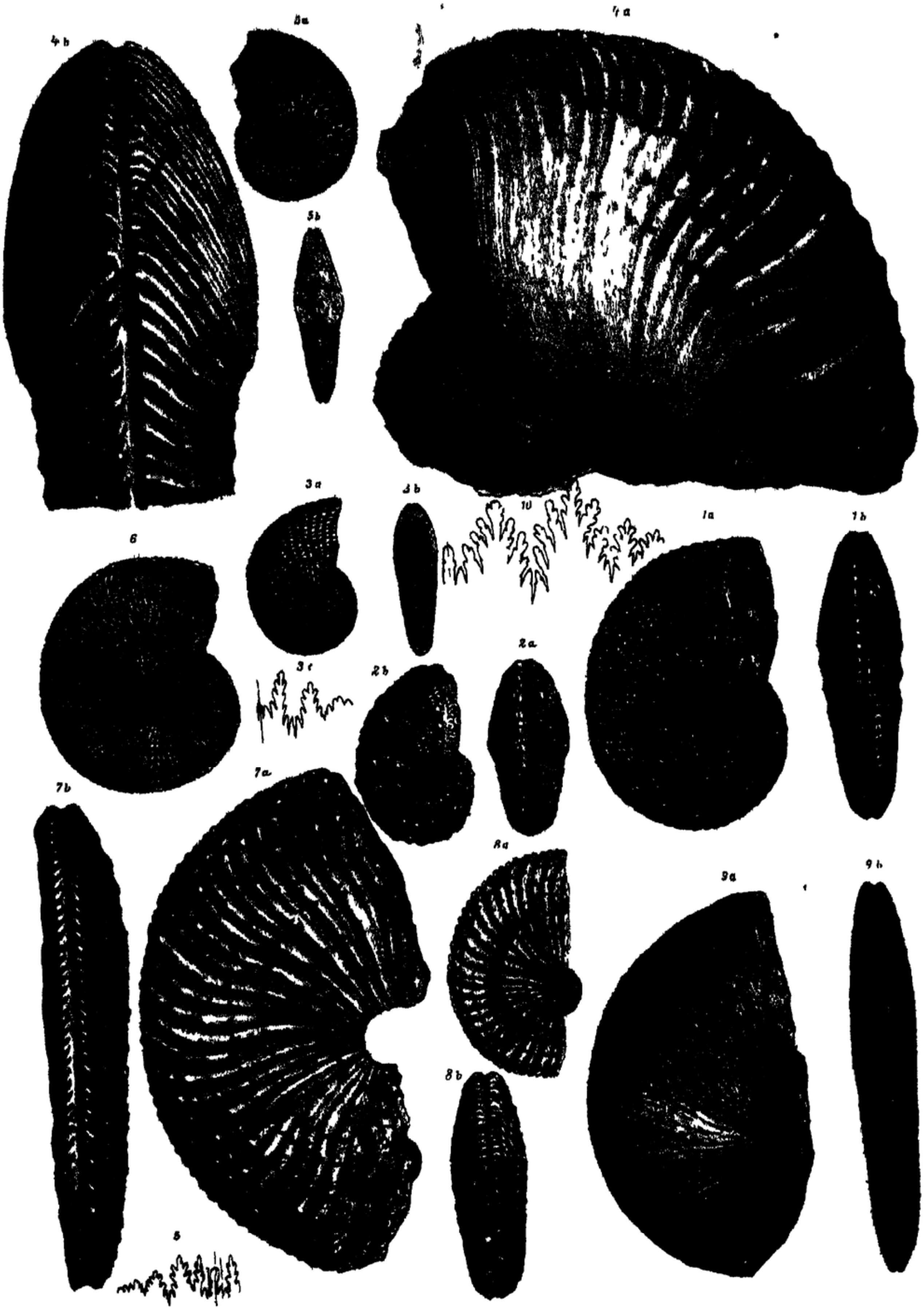
„ 9*a*, *b*. „ Vredenburgi Diener. Kalapani, coll Krafft.

„ 10. Jovites spectabilis Diener. (Sutures). Kalapani, coll. Smith.

Pl. IX

Geol. Surv of India.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



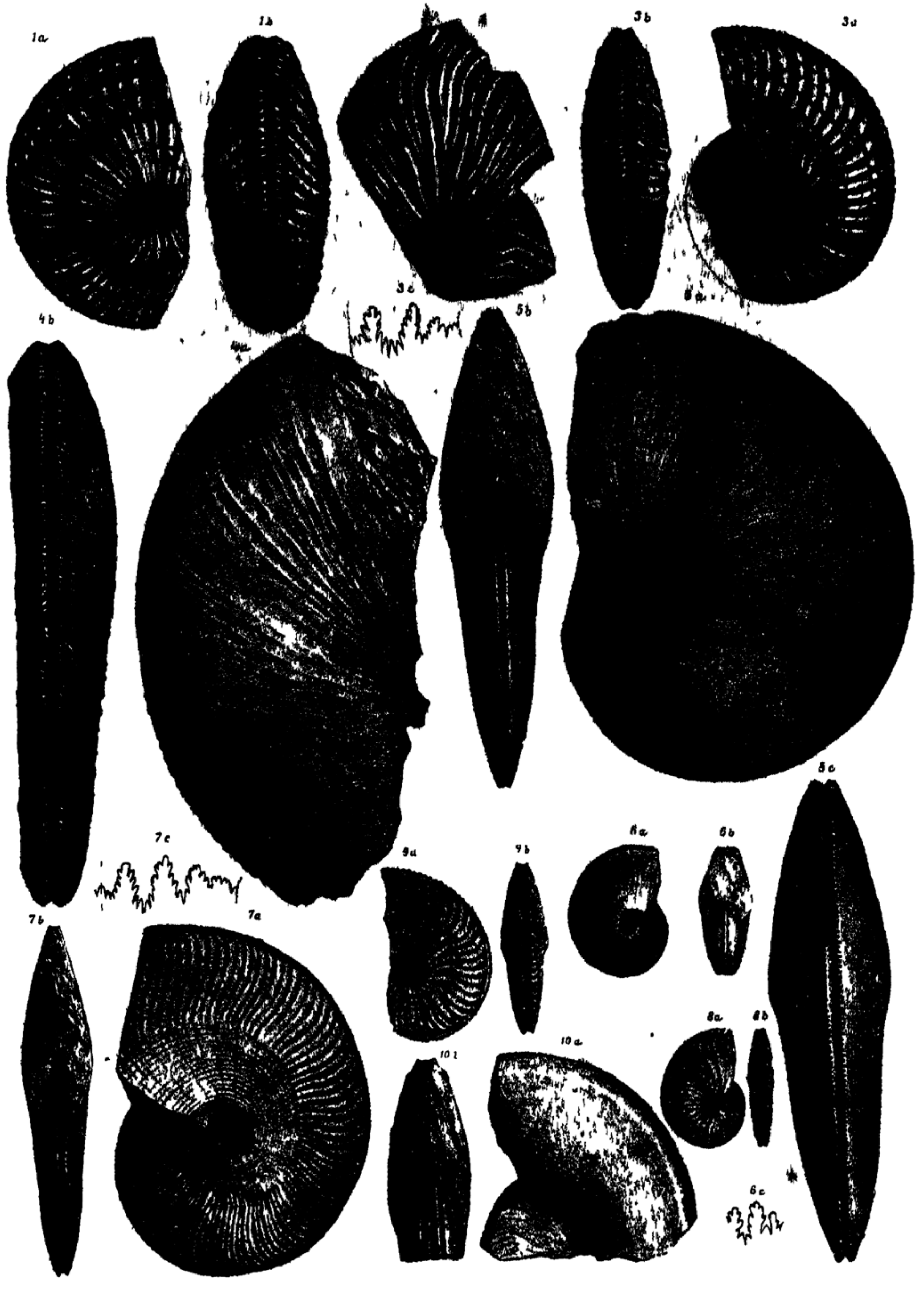
A Swoboda del et lith

Albert Berger print

PLATE X.

Fig. 1*a*, *b*. SIRENITES ARGONAUTAEFORMIS Diener. Tera Gádh, coll. Smith.
" 2. " SP. IND. AFF. KOHANYI Mojs. " " " "
" 3*a*, *b*, *c*. " CF. DIANAE v. Mojsisovics. " " " "
" 4*a*, *b*. " SP IND. AFF. VREDENBURGI Dien. Lilinthi, coll. Krafft.
" 5*a*, *b* " ALIXIS Diener. Tera Gádh, coll. Smith.
" 6*a*, *b*. *c*. PARATROPITES (?) LILINTHICUS Diener. Lilinthi, coll. Smith.
" 7*a*, *b*, *c*. ANASIRENITES GREENI Diener. Kalapani, coll. Smith.
" 8*a*, *b*. SIRENITES CF. PAMPHAGUS v. Dittmar. Kalapani, coll. Smith.
" 9*a*, *b*. " PAMPHAGUS v. Dittmar. " " "
" 10*a*, *b*. ANASIRENITES CF. MENELAUS Mojsisovics. " " "

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



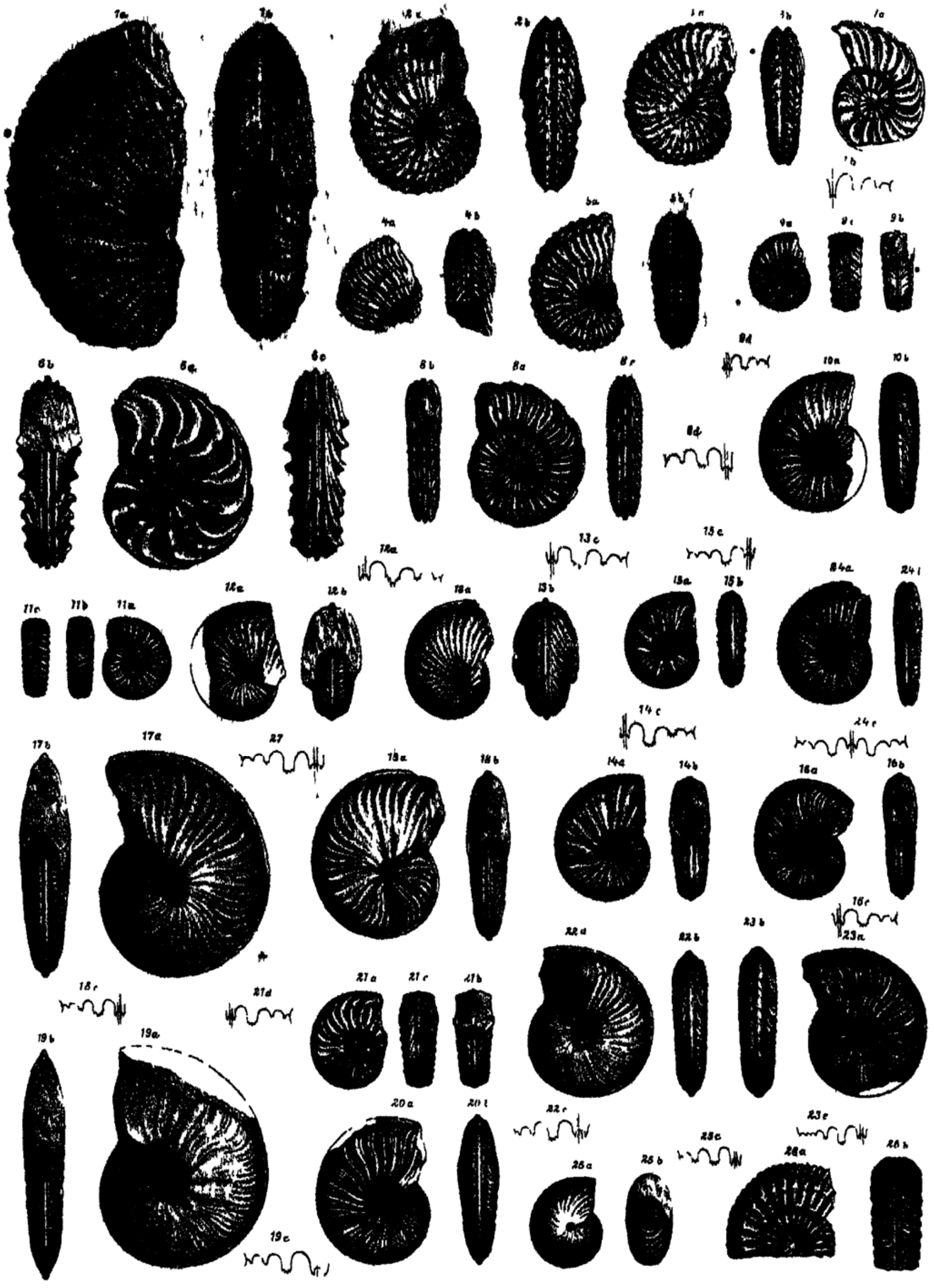
A.Swoboda del et lith

Albert Berger print

PLATE XI.

Fig. 1a, b	Acanthinites (Himavatites) Watsoni Diener. Body-chamber. Tera Gádh, coll. Krafft.
,, 2a, b.	Dionites sp. ind. aff. Cæsar Mojs. Tera Gádh, coll. Krafft.
,, 3a, b.	Protrachyceras Ansoni Diener. Kalapani, coll. Krafft.
,, 4a, b.	,, nov. sp. ind. Tera Gádh, coll. Smith.
,, 5a, b.	,, Ansoni Diener. Kalapani, coll. Krafft.
,, 6a, b, c.	Jellinekites Barnardi Diener. Lilinthi, coll. Krafft.
,, 7a, b.	,, Saundersi Diener. ,, ,, ,,
,, 8a, b, c, d.	,, Hoveyi Diener. . ,, ,, ,,
,, 9a, b, c, d.	Dittmarites teragádhensis Diener. Tera Gádh, coll. Smith.
,, 10a, b.	Phormedites sp. ind. aff. Juvavico Mojs. Kalapani, coll. Krafft.
,, 11a, b, c.	Buchites cf. hilaris Mojsisovics. Kalapani, coll. Krafft.
,, 12a, b, c.	Thisbites Campbelli Diener. Tera Gádh, coll. Smith
,, 13a, b, c.	,, ,, ,, ,, ,, ,, ,,
,, 14a, b, c.	,, Windhami Diener. ,, ,, ,, ,,
,, 15a, b, c.	,, ,, ,, ,, ,, ,, ,,
,, 16a, b, c.	Parathisbites cf. Hyrtli Mojsisovics. Tera Gádh, coll. Krafft.
,, 17a, b, c.	Thisbites Meleagri Mojsisovics. ,, ,, ,, ,,
,, 18a, b, c.	,, ,, ,, Lilinthi, coll. Krafft.
,, 19a, b, c.	,, Ronaldshayi Diener. ,, ,, ,,
,, 20a, b.	,, ,, ,, Tera Gádh, coll. Smith.
,, 21a, b, c.	Parathisbites nodiger Diener. Kalapani, coll. Krafft.
,, 22a, b, c.	,, cf. scaphitiformis v. Hauer. Tera Gádh, coll. Smith
,, 23a, b, c.	,, ,, ,, ,, ,, ,, ,, ,,
,, 24a, b, c.	Daphnites sp. ind. aff. Ungeri Mojs. Kalapani, coll. Krafft.
,, 25a, b, c.	Isculites Smithii Diener. Tera Gádh, coll. Smith.
,, 26a, b.	Trachypleuraspidites Griffithi Diener. Lilinthi, coll. Krafft.
,, 27	Parathisbites scaphitiformis v. Hauer Sutures of a specimen from the noric Hallstatt limestone of the Sommeraukogel (Salzkammergut)

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA).



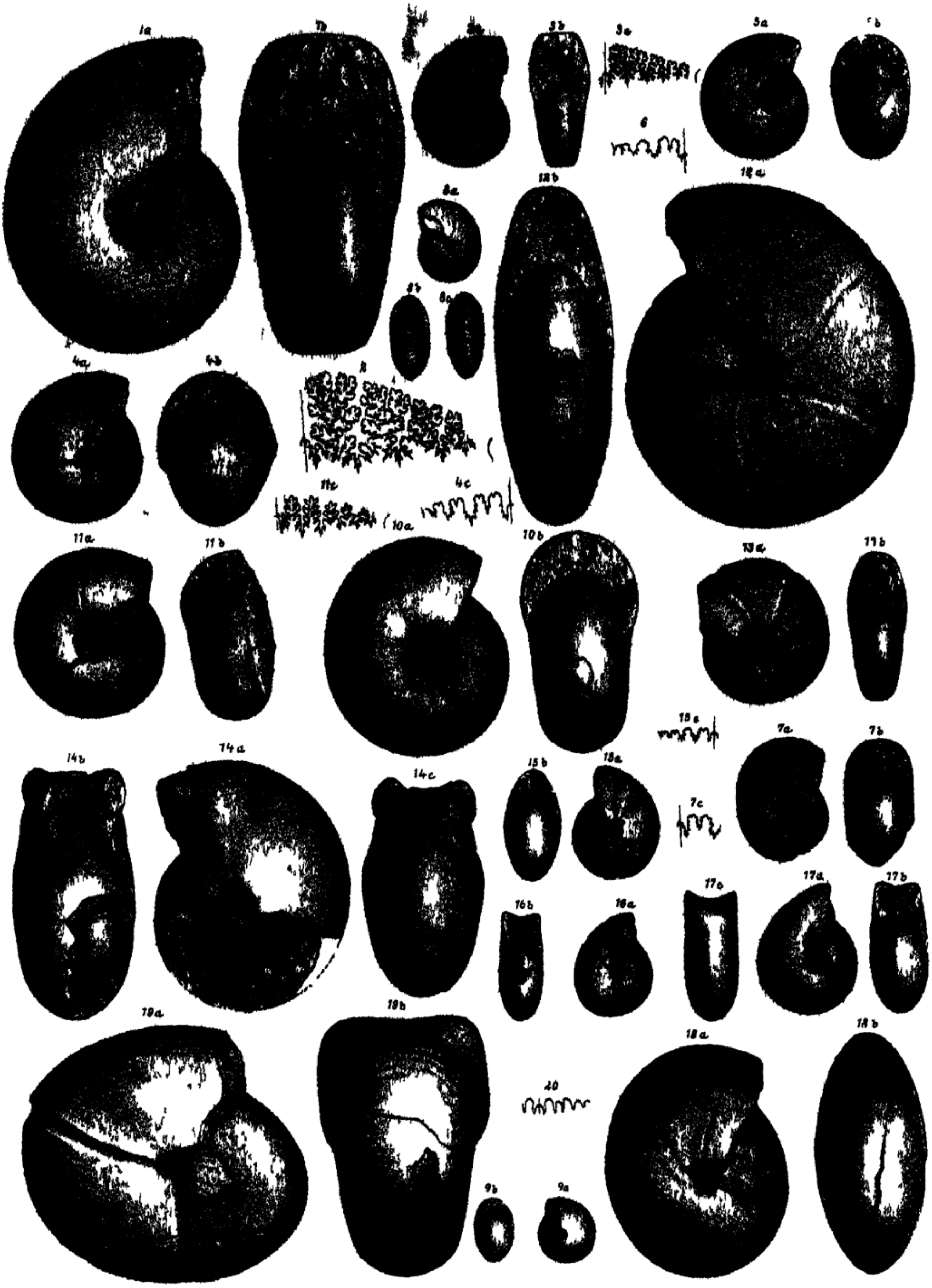
A. Swoboda del et lith

Albert Berger print

PLATE XII.

Fig. 1*a*, *b*. **Cladiscites cf. neortus Mojsisovics. Lilinthi, coll. Krafft.**
„ 2. „ „ „ „ **Sutural line. Tera Gádh, coll. Smith.**
„ 3*a*, *b*, *c*. „ **sp. ind. aff. moroso Mojsisovics. Kalapani, coll. Smith.**
„ 4*a*, *b*, *c*. **Didymites tectus Mojsisovics. Tera Gádh, coll. Krafft.**
„ 5*a*, *b*. „ „ „ **Kalapani, coll. Krafft.**
„ 6. „ **sp. ind. aff. subglobus Mojs. Sutural line. Kalapani, coll. Krafft.**
„ 7*a*, *b*, *c*. „ **sp. ind. aff. Quenstedti Mojs. Kalapani, coll. Krafft.**
„ 8*a*, *b*, *c*. **Lobites sp. ind. cf. ellipticus v. Hauer.** „ „ „
„ 9*a*, *b*. „ „ **(aff pisum Muenst ?)** „ „ „
„ 10*a*, *b*. **Proarcestes cf. Gaytani Klipstein. Body-chamber. Kalapani, coll. Smith.**
„ 11*a*, *b*, *c*. „ „ „ „ **Inner nucleus with sutures. Kalapani, coll. Smith.**
„ 12*a*, *b*. „ **sp. ind. aff. sublabiato Mojs. Lilinthi, coll. Krafft.**
„ 13*a*, *b*. **Stenarcestes sp. ind. aff. polysphincto Mojs. Kalapani, coll. Krafft.**
„ 14*a*, *b*, *c*. **Arcestes dicerus v. Mojsisovics. Kalapani, coll. Krafft.**
„ 15*a*, *b*, *c*. **Didymites Kitchini Diener.** „ „ „
„ 16*a*, *b*. **Arcestes bicornis v. Hauer. Tera Gádh, coll. Smith.**
„ 17*a*, *b*, *c*. „ „ „ „ „ „ „
„ 18*a*, *b*. **Proarcestes cf. Sturi Mojsisovics. Kuti, coll. Krafft.**
„ 19*a*, *b*. „ **nov. sp. ind. aff. Zitteli Mojs. Kalapani, coll. Krafft.**
„ 20. **Lobites sp. ind. cf. ellipticus v. Hauer. Sutural line from a specimen, whose body-chamber has been scaled-off. Twice natural size. Kalapani, coll. Krafft.**

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



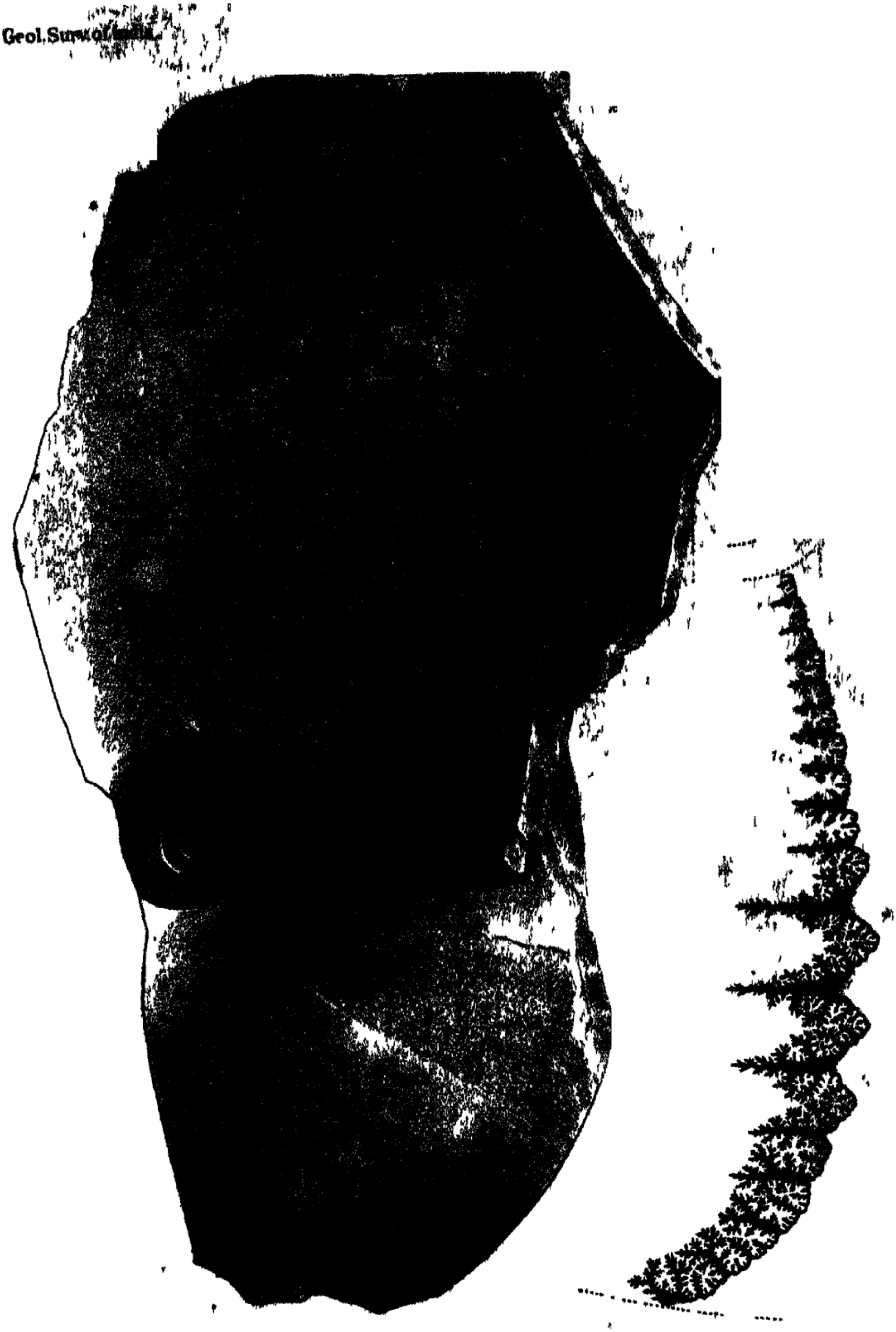
A Swoboda del et lith

Albert Berger print

PLATE XIII.

Fig. 1*a*, *b*. *c*. PINACOCERAS METTERNICHII v. Hauer *var*. *a*, two-thirds natural size ; *b*, transverse section natural size, the second half of the last volution having been omitted ; *c*, sutural line, natural size. Tera Gádh, coll. Smith.

„ 2. PINACOCERAS BEECHERI Diener. Tera Gádh, coll. Smith.



R Mayer del et lith.

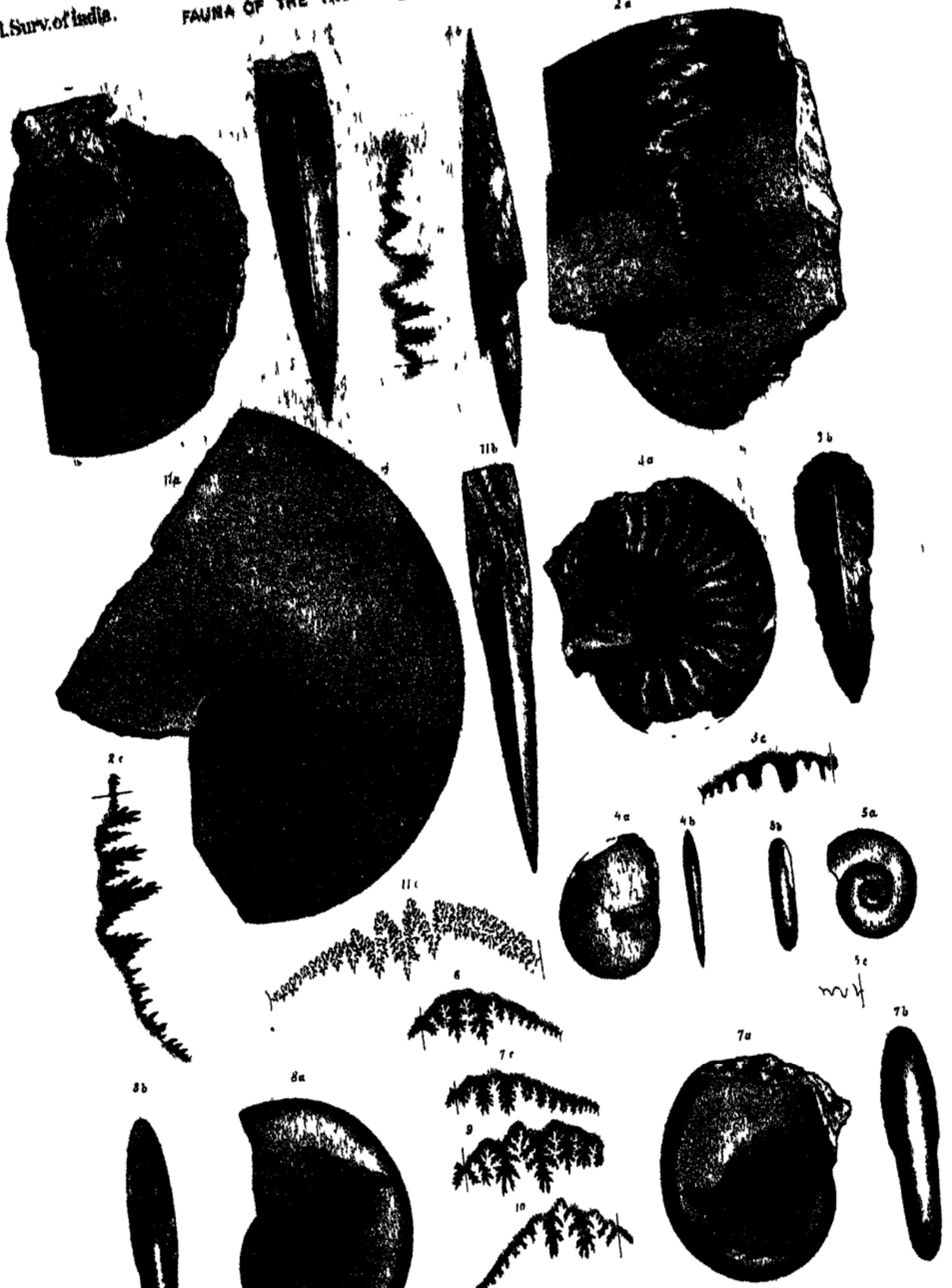
PLATE XIV.

Fig. 1*a*, *b*. Carnites cf. floridus Wulf. Lilinthi, coll. Krafft.
" 2*a*, *b*, *c*. Bambanagites Kraffti Diener. Lilinthi, coll. Krafft.
" 3*a*, *b*, *c*. Paratibetites cf Geikiei Mojsisovics. Lilinthi, coll. Krafft.
" 4*a*, *b*. Pinacoceras cf. rex Mojsisovics. Tera Gádh, coll. Krafft.
" 5*a*, *b*. Isculites sp. ind. aff. obolinus v. Dittmar. Tera Gádh, coll. Krafft.
" 6. Placites sp. ind. ex. aff. perauctus Mojs. Sutures. Lilinthi, coll. Smith.
" 7*a*, *b*, *c*. " polydactylus *var.* Oldhami Mojs. Tera Gádh, coll. Krafft.
" 8*a*, *b*. " " " " " Tera Gádh, coll. Smith.
" 9. " " " " " Sutures. Tera Gádh, coll. Krafft.
" 10. " " " " " Sutures. Tera Gádh, coll. Smith
" 11*a*, *b*, *c*. Pinacoceras parma v. Mojsisovics. Lilinthi, coll Krafft.

Pl. XV

Geol. Surv. of India.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)



A Swoboda del et lith

Albert Berger print

PLATE XV.

Fig. 1*a*, *b*, *c*. Isculites Heimi v. Mojsisovics. Tera Gádh, coll. Krafft.

„ 2*a*, *b*. Halorites sp. ind. aff. procyon Mojs. Kalapani, coll. Smith.

„ 3*a*, *b*, *c*. Gonionotites Gemmellaroi Diener. Full-grown individual with its body-chamber. Kalapani, coll. Smith.

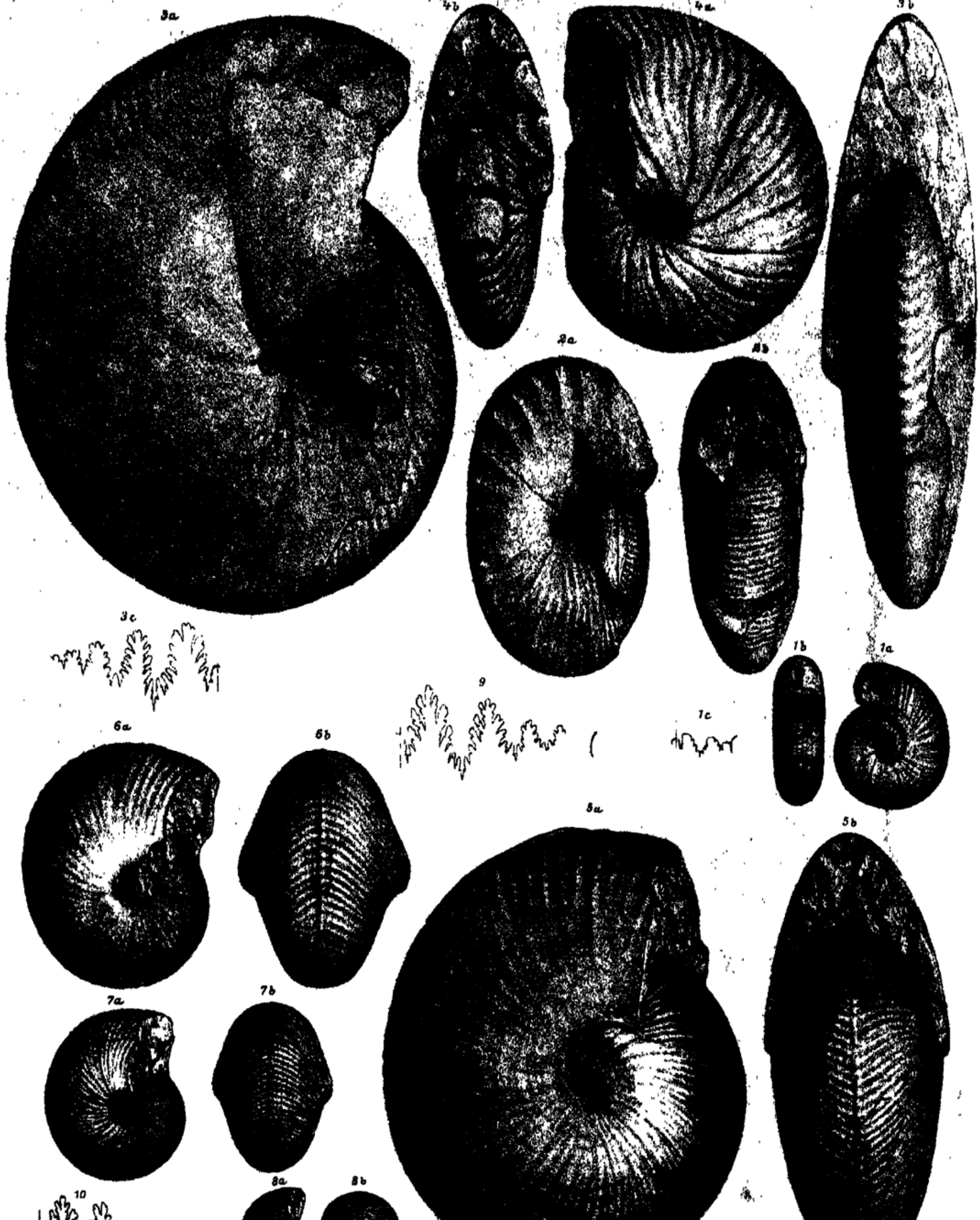
„ 4*a*, *b*. Gonionotites Gemmellaroi Diener. Inner nucleus of a full-grown individual. Kalapani, coll. Smith.

„ 5*a*, *b*. Jovites daciformis Diener. Typical form; full-grown individual. Kalapani, coll. Smith.

„ 6*a*, *b*.
„ 7*a*, *b*. } Jovites daciformis Diener. Inner nuclei. Kalapani, coll. Smith.
„ 8*a*, *b*.

„ 9.
„ 10. } Jovites daciformis Diener. Sutures. Kalapani, coll. Smith.

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA).



A. Swoboda del. et lith.

Albert Berger print.

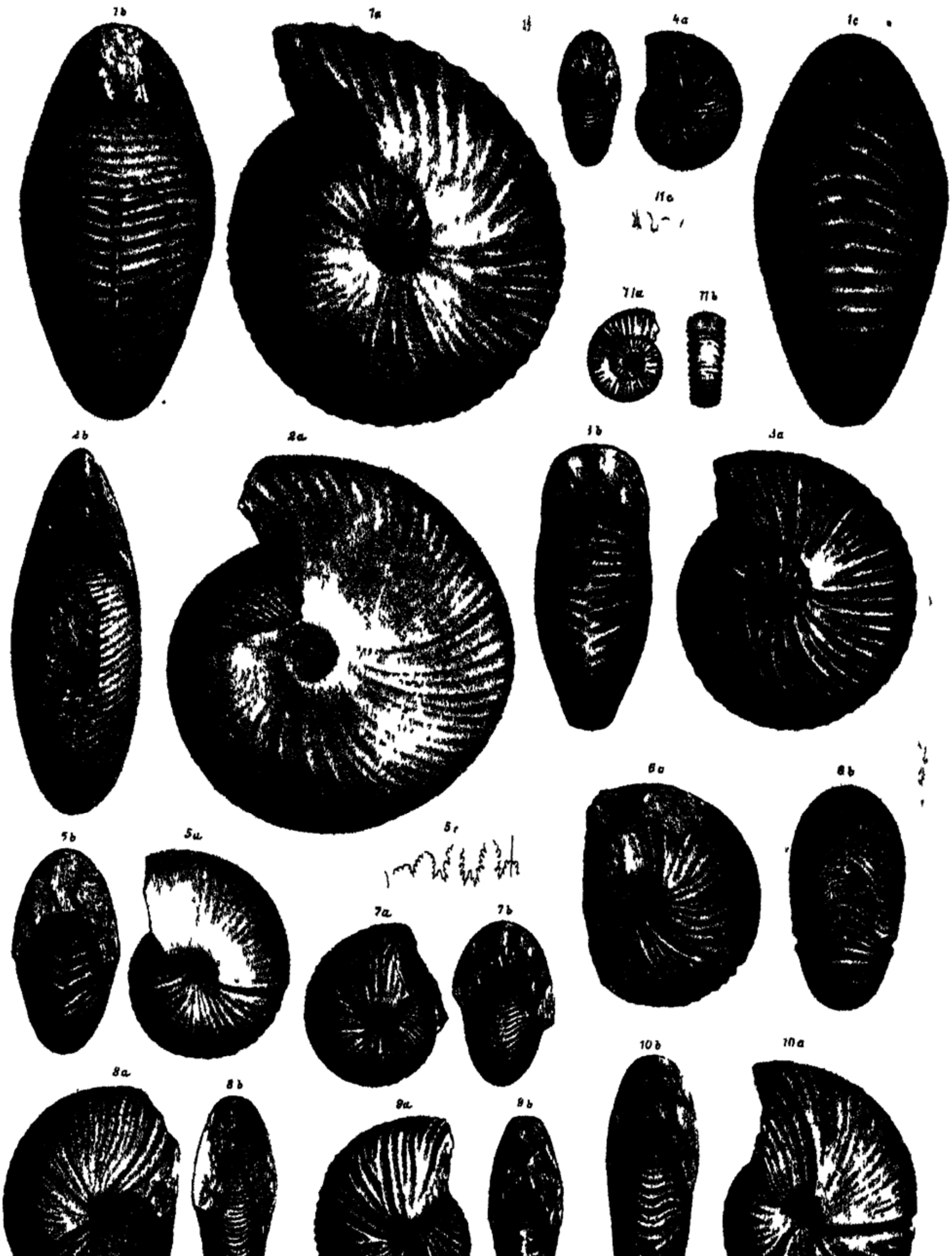
PLATE XVI.

Fig. 1*a*, *b*. **Jovites spectabilis** Diener. Kalapani, coll. Smith.
„ 2*a*, *b*. „ **daciformis** Diener. „ „ „
„ 3*a*, *b*. **Parajuvavites Jacquini** Mojsisovics. Tera Gádh, coll. Smith.
„ 4*a*, *b*. **Anatomites**, cf. **Theodori** Mojsisovics. Kalapani, coll. Smith.
„ 5*a*, *b*, *c*. „ cf. **crasseplicatus** Mojsisovics. „ „ „
„ 6*a*, *b*. „ sp. ind. aff. **Fischeri** Mojs. „ „ „
„ 7*a*, *b*. „ cf. **Edgari** Mojsisovics. „ „ „
„ 8*a*, *b*. „ **Beresfordi** Diener. Kalapani, coll. Krafft.
„ 9*a*, *b*. „ **speciosus** Diener. Nihal, coll. Krafft.
„ 10*a*, *b*. „ cf. **Fischeri** Mojsisovics. Kalapani, coll. Smith.
„ 11*a*, *b*, *c*. **Sibirites** (**Metasibirites** ?) **Philippii** Diener. Kalapani, coll. Krafft.

Geol. Surv of India

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA).

Pl. XVI



A Swoboda del et lith

Albert Berger print

PLATE XVII.

Fig. 1*a*, *b*, *c*. GRYPOCERAS SP. IND. AFF. MESODICO Hauer. Kalapani, coll. Smith.

,, 2*a*, *b*, *c*. *d*. PROCLYDONAUTILUS GRIESBACHIFORMIS Diener. Lilinthi, coll. Krafft.

,, 3*a*, *b*. ORTHOCERAS CF. TRIADICUM Mojsisovics. Tera Gádh, coll. Smith.

,, 4*a*, *b*, *c*. ATRACTITES CF. ELLIPTICUS Mojsisovics. *a*, ventral view of the phragmocone; *b*, lateral view; *c*, interior of an air-chamber. Kalapani, coll. Smith.

,, 5*a*, *b*. ATRACTITES CF. CONVERGENS Hauer. *a*, ventral view; *b*, transverse section. Kalapani, coll. Smith.

,, 6*a*, *b*. LOXONEMA SP. IND. Kalapani, coll. Krafft.

,, 7. AVICULA SP. IND. AFF. TOFANÆ Bittner. Left valve. Kalapani, coll. Krafft.

,, 8. ,, ,, ,, ,, CAUDATA Stoppani. ,, ,, ,, ,, ,,

,, 9. HALOBIA CF. FASCIGERA Bittner. Left valve. Kalapani, coll. Krafft.

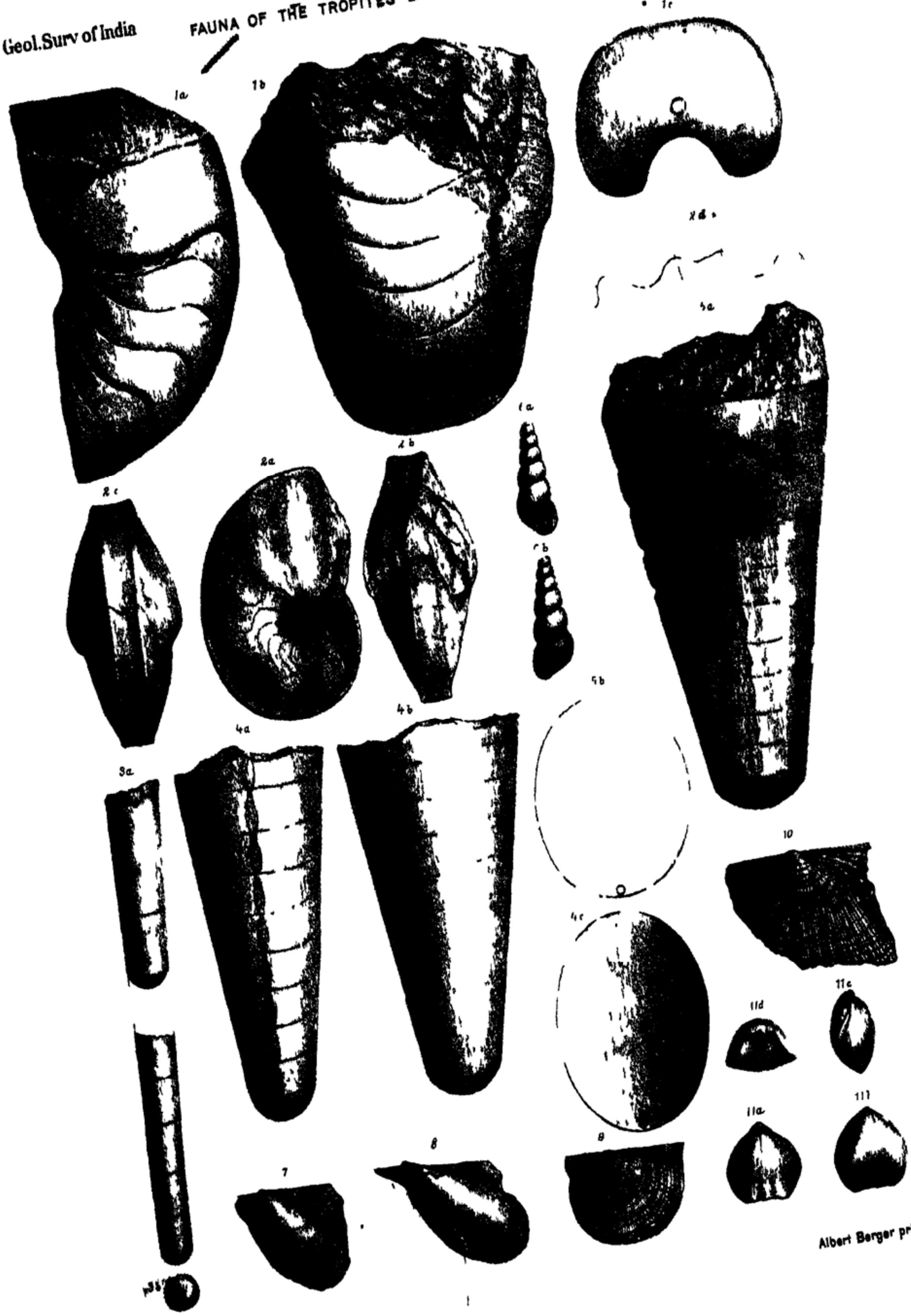
,, 10. ,, ,, ,, ,, ,, ,, ,, ,, ,

,, 11*a*, *b*, *c*, *d*. RHYNCHONELLA ANGULIFRONS Bittner. *a*, dorsal view; *b*, ventral view; *c*, lateral view; *d*, front view. Lilinthi, coll. Krafft.

Geol. Surv of India

FAUNA OF THE TROPITES LIMESTONE (HIMALAYA)

Pl. XVII



A Swoboda del et lith

Albert Berger print